



Spatialising ‘carceral mobilities’: extracting census data for analysis of prisoner inflow, transfer and release

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Abstract

Responding to the dearth of fully-comprehensive or summary data on prisoner or ‘carceral mobilities’, this paper provides the first comprehensive case study analysis of the flow into, between and out from prisons. By uniquely extracting data from the 2011 UK Census to identify and visualise trends in movement, highlight centrality of institutions and observe the self-containedness of regions of operation, findings reveal specific volumes and geographies of prisoner flow as well as discrepancies with the expected practices of prison category transfers and disparities between the distances travelled by prisoners in establishments with different functions. Such analysis is a critical tool in appraising (in)efficiencies with the governance of prisons at the regional and national level. In conclusion, Census Data is revealed as a viable source of data for analysis in situations where institutional data is not forthcoming/available, which provides significant potential for the advancement of the range and scope of studies in carceral mobilities and criminological research more broadly.

Keywords Carceral mobilities · Prisoner movement · UK Census · Eigenvector centrality · Self-containedness

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Introduction

It is often plausibly assumed that ‘prison’ and ‘movement’ are contradictory terms. The intrinsic principle of a material and metaphorical divide between ‘criminals’ and the rest of society generates an assumed boundary between movement and stasis [48]. As Turner and Peters explain, “[o]utside of these sites is a presumed autonomy of movement, a liberty to move freely. Inside, there is an assumed prohibition of movement, an imposed stasis and inability to move at will” (2017, p. 1). However, articulations of such stasis obscure the inherent, power-filled mechanism of incarceration itself – to *remove* individuals from wider society. Such means to exercise spatial control have long been practiced throughout civilisation – notions of expulsion and containment are intrinsic components of society [4]. Accordingly, then, the apparent immobilisation of the carceral body is underscored by a particular mobilising of power to confine, contain and detain. Prison spaces, then, following Turner and Peters “evok[e] a visual trickery; an illusion of immobility, where instead [they] are often underscored by mobilities” (2017, p. 2).

In recent years, carceral scholars have taken influence from mobilities studies to destabilise the assumptions of incarceration as ‘fixed’ experience(s). In doing so, a growing body of work in geography (in particular) has interrogated mobilities in the penal context. Such work, which is later further outlined in our literature review, ranges from analysis of macro-scale movements of convicts (e.g. in a historical analysis of the transportation of sentenced convicts from the UK to Australia in the nineteenth century [47, 61]) to rare glimpses of movement between institutions within prison systems (such as via the rail networks of the *etapirovaniya* in the contemporary Russian Federation [38]). Concluding their work on Russia, Moran et al. recognise the potential merit of “surfacing the structures of discipline and autonomy underlying the ‘everyday’ forms of mobility” (2012, p. 457) inherent in landscapes of incarceration. This paper goes some way to respond to this appeal, focusing attention specifically upon the fundamental movements innate to incarceration: entry into prison (here termed inflow) and release from prison. Between April and June 2022, 15,944 people were received into- and released from prison in England and Wales [35]: no page). Such flux is unsurprising when related to sentencing decisions: 30% of prisoners in England and Wales have a sentence of less than 4 years [58], p. 10). In addition, 10,448 prisoners were recalled to prison during April to June 2022 [34, 35], no page), indicating significant inflow as a result of breach of the terms of release on license. Accordingly, movement into and out from prison is very much an ‘everyday’ component of the prison system.

In addition to inflow and release, during the same period there were also “18,286 incidences of prisoner transfer, with 15,596 prisoners having at least one incidence of transfer” [35], no page). As the literature review will more extensively discuss, transfer between prison institutions can be highly disruptive to prison experience, having a bearing upon access to healthcare and education as well as having implications for the friends and family of the incarcerated persons.

Accordingly, the significance of transfer has been recognised in a wealth of prison scholarship, but such attention is often limited to smaller-scale qualitative, often highly-individualised, personal narratives or custodial journeys (e.g., Gill's [18] elicited narratives of the movement of detained asylum seekers around Britain's detention estate). This reflects the myriad methodological challenges in prisons research, where fully-comprehensive or summary data are often very difficult or even impossible to glean.

In this paper, we therefore adopt a novel measure of census flow data to supplement the statistics available by the Ministry of Justice and to remedy the lack of larger-scale prisoner-generated information about incarcerated persons. We draw upon data on current and previous postcode location from the 2011 UK Census to identify and visualise trends in movement into, between and out from prisons in England and Wales, and make observations in relation to existing data outcomes. Our analysis illustrates the scope and range of inflow and outflow locations, to highlight movements and ergo connectedness between the prison system and 'outside' locations. Additionally, the novel approach to data analysis offered here also allows us to map and analyse *transfers between* individual prison establishments for the first time. In the following, we highlight the academic literature that rationalises our attention to prisoner movements before outlining our data sources and methodological approach. We then separate our results into two substantive sections: we first outline the patterns of inflow, release and transfer according to establishment function and security classification. We follow with a discussion of the centrality of particular establishments and the self-containedness of regions of operation. We close by reiterating the utilisation of census data to extend the range and scope of studies in carceral studies and criminal justice more broadly. In our case, we conclude by highlighting a disparity between the distances travelled by prisoners in establishments with different functions and a distinct overlap between regions of operation in England and Wales, suggesting some inefficiencies with the governance of prisons in these regions. In addition, we illustrate discrepancies with the expected practice of category transfers.

Movements in incarceration

By focusing on incarceration as a whole-scale removal of individuals from society, scholars have dispelled the myth of confinement as a space of immobility or the condition of the prisoner as immobile, to instead recognise movement as inherent in carceral space and the lived experience of those imprisoned. This work reflects developments in the 'mobilities turn' to further interrogate the power of movement at different scales. Investigating, for example, the mobilisation of belongings in cell space [53] or the forced movement of prisoners aboard convict ships [47, 61], academic work recognises the disciplining power of mobilities and the deliberate use of (im)mobility as a tool for control, which has led to terms such as 'coercive mobility', 'disciplined mobility' [38] and specifically '*carceral mobilities*' [60].

A key thematic area is the transfer or 'churn' of carceral bodies at a variety of scales. This includes movement between institutional spaces, such as within national

prison and immigrant detention systems. For example, Michalon “reveals the importance of the movements between the different places that make up the ‘detention universe’ (detention centres, police offices, offices of institutions in charge of migration, consulates etc.), both in Romania and at a European level” (2013, p. 39) through their ethnographically-informed fieldwork comprising interviews with detainees and former detainees in Romania. This work revealed mobility as intrinsic to ‘procedure’ but also ‘punitive’ effect. Mobilities are also noted across national boundaries as in the outsourcing of prisoner populations to other countries (creating so-called ‘trans-national’ prisoners via ‘deals’ signed by national governments, such as between the Netherlands and Belgium and the Netherlands and Norway [45], or in intra-continental movement such as the “circulation of enslaved people, indentured laborers, convicts, displaced persons, and labor migrants” via, often European, colonial mechanisms [2], p. 169). Attention is also paid to the forced mobilities—and the vehicles of such mobilities—demanded by complex legal and extra-territorial practice such as deportation/rendition [13, 19, 49, 64], and in the context of forced-migration and asylum (such as movements across land boundaries or via sea [12, 16, 40]¹).

Beyond recognising and theorising these mobilities practices, geographers and other spatial scientists have made significant attempts to map the movement(s) of incarcerated persons. This includes, for example, charting known transit routes (e.g., movement between prison institutions via elongated and, often, random rail travel in the aforementioned work by Moran et al. [38] in Russia; the interlinking pathways noted by Michalon [29] within and beyond the Romanian detention estate; and creating travel timelines between major urban centres and prison establishments [9]). Examples that interrogate carceral mobilities, then, are numerous and wide-ranging. Yet, they are largely qualitative or smaller-scale in their manifestation. For example, the aforementioned mapping often draws upon data at the individual level. For example, Hiemstra’s construction of six, individual ‘detention transfer paths’ to unpack economic influence of detention apparatus derived from interviews with Ecuadorian migrants detained in and deported from the US. This nature of the data often reflects the myriad methodological challenges in prisons research, particularly in the context of England and Wales where fully-comprehensive or summary data are often very difficult, or even impossible, to glean: they are often a result of aspects such as (but not limited to) restrictions on access to institutional data [39, 54] or the logistical challenges of engaging released prisoners as participants [25]. These smaller-scale, qualitatively-informed, often highly-individualised, personal narratives or custodial journeys are valuable in unpacking prisoner experiences but may be less effective in highlighting the patterns and (in) consistencies of carceral mobilities on, say, the scale of a whole prison system. Furthermore, such is

¹ There is also significant emergent work that takes influence from the ‘mobilities turn’ to highlight and interrogate the numerous so-called ‘micro-mobilities’ that are often associated with prisoner experiences, such as the ‘journeys’ of contraband (Lankenau, 2001). Furthermore, a variety of other experiences of movement beyond traditional landscapes of imprisonment have also been conceptualised as carceral (Moran et al., 2018) (such as the mobilities of young homeless in the city [Jackson, 2012]). However, although we recognise the wealth and depth of such engagements, a thorough exegesis of this body of literature is beyond the scope of our project, which focuses on larger-scale movements to, from and between individual prison establishments.

the numerosity and complexity of prisoner movement, that the reported accounts are often both difficult to quantify and, perhaps, often incomplete (as may be alluded to from the narratives of former-prisoners that are the foundation of Mitchelson's [37] account of the complexity and unpredictability of movements across the US Department of Corrections. In many cases, these movements (and ergo the persons subject to them) are often simply rendered 'invisible' to and in academic scholarship (Gill and Simon [19]).

Yet, drawing influence from existing literature about the wider impacts and practices of the prison system, we understand that prisoner experiences (and those of the persons also impacted by secondary prisonisation [14], such as friends and family) are conceivably contingent upon the mobilities inherent in incarceration. For example, there is widespread general discussion around the impact of distance from home to sites of incarceration. Lindsey et al. [27] reported in their study in Florida, US, that increased distance from home also increased prisoner misconduct. In addition to the prisoner-focussed research, much of the work on incarceration distance adheres to the perspectives of friends and relatives, who are themselves the 'mobile bodies' who are required to travel to penal establishments for visits (see, for example, Dixey and Woodall [17]). Geographic separation challenges the maintenance of relationships [56], regardless of whether it involves one or more parties being incarcerated. Depending on the country context, prisons are often located in remote, rural areas and, accordingly, families must often negotiate a series of barriers—often related to cost, time and significant waiting periods—and create management strategies to overcome physical (as well as metaphorical) distances [9]. It may be that some challenges are not feasibly surmountable, as for the visitors to the older population who, in Hayes et al.'s [23] analysis of the North West region of England and Wales, may themselves be older and therefore less financially-equipped and/or physically able to make long-distance visits [41, 44]. In their Minnesota case study, Clark and Duwe [10] found that, as distance between visitors and prisons increased, the frequency of visitation decreased. This is inherently problematic because familial ties are crucial—both to the prisoner themselves but also to, for example, children whose parents are imprisoned. Imprisoned parents have diminished capacity to contribute to parenting roles, which often has negative impact upon sense of self and conceptualisation of parenting ability, evoking feelings of helplessness at the consequences for the child [11]. On the latter in particular, it has been noted that "parental imprisonment has detrimental consequences for children's mental health and the strength of parent-child relationships" and regular contact may "protect against these adverse outcomes" [51], p. 761). Accordingly, spatialising proximity from home (as a result of processes of prison inflow and transfer) might facilitate better understanding of how widespread the challenges of combatting geographical distance are in any given context—in our case, England and Wales. We are also cognisant of potentially-disproportionate experiences of women, for whom geographical distance may be exacerbated due to fewer establishments housing this population and for whom the loss of familial ties can be especially difficult [8]. Such disproportionality may also extend to prisoners in specialist categories who are also often similarly unequally distributed (e.g., [46]).

Similarly, and at the other end of the scale, aspects of release are also reportedly of significant consequence for efforts to encourage prisoner resettlement (see [28], among others). Prisoners experience a variety of challenges in returning to (or, in many cases, starting new lives in) communities outside of imprisonment. These often include logistical and stigma-related barriers to accessing and maintaining consistency in housing, healthcare and employment [21, 26], which often results in a propensity to move more than in pre-prison periods [65]. Additionally, a range of psychological and social attributes cohere, and often relate, to the feeling of separation or lack of belonging caused by feelings of symbolic or temporal distance between the individual and the persons around them [20]. It is feasible therefore that physical distance is also likely to have a bearing upon these aspects too. Prisoners returning to distal surroundings may experience even less common ground with their community, perhaps having struggled to maintain familial ties. Although, in their Michigan study Harding et al. [21] found that less than one-third of their sample returned to an address within half a mile of their pre-prison residence, Harding et al. [22] found that the majority of released prisoners lived with family or romantic partners on release, thus signifying the importance of maintaining family links during incarceration to facilitate this support. Furthermore, those incarcerated for a length of time in establishments far removed from their last non-prison-residential address may develop socio-cultural ties (i.e., develop regional accents, sporting affiliations, etc.) to a different community than the one to which they are released [54], including the prison itself as a ‘home’ [59]. As Turner [59] explains, such ties can represent almost ‘diasporic’ identities, making re-entry to previous communities and the performance of previous identities difficult. On the contrary, social and cultural proximity to a neighbourhood is not necessarily assumed to be positive. For example, Stahler et al. [57] questioned how release into local neighbourhoods with existing and strong community ties impacted recidivism levels—the so-called effect of “spatial contagion.” In a similarly quantitative approach, Harding et al. [21] focus attention on whether individuals return to pre-prison neighbourhoods, but such attention—although thorough, for example, in its interrogation of various other aspects of housing provision—does not attempt to capture data at a national level.

Although the rate of transfer between prisons is seldom explored, research reveals the process as also highly consequential. The frequent and, often seemingly-unpredictable movement of prisoners across the estate necessarily demands a period of ‘settling in’ and adjusting to the new regime, which can often be challenging for specific groups—older prisoners suffer again here too [7]. Often, prisoners find it difficult to know what to expect: at best, an uncertainty about regime changes that are largely resolved after the initial reception period [30], at worst, complete lack of information about the transfer location [38]—knowledge often contingent upon the regulations of the penal system individuals are housed within. The challenges of adjustment can also be exacerbated by the ability of transferred-individuals to complete programmes, particularly healthcare treatment programmes [15] and result in delay of the transfer of medical records and therefore disruption of medication supply [5]. High levels of prisoner mobility also reportedly impact effective monitoring and sanctioning of prisoners involved in e.g., drug-dealing and circulation of other contraband, when infringement paperwork moves through the system more slowly

than the person (or, indeed, never arrives at all) [55]. And, of course, it must be recognised that transfers often result in positive impacts upon incarceration experience, such as in the case of the enhanced liberty and opportunities usually offered by a move from a more- to a less-secure category of establishment [30].

Given their significance upon both prison and post-release life, scholars have, arguably then, thus far been unable to sufficiently interrogate the aforementioned ‘everyday’ and numerous mobilities of prison life—inflow, transfer and release—to form a wider picture of these movements at a national scale. Accordingly, then, this paper goes some way to understanding these movements as a comprehensive system. In the following section, we introduce our case study and methods before presenting our interrogation along these lines [6].

Case study and methods

In England and Wales, the prison system operates under the oversight of His (formerly-Her) Majesty’s Prison and Probation Service (HMPPS), a governmental body responsible for managing all aspects of incarceration and rehabilitation.² In 2011, there were 141 prisons and young offender institutions, with facilities ranging from high-security establishments, such as Belmarsh and Long Lartin, to open prisons like Springhill. The prison estate was divided into 11 geographical regions (with a separate operational authority for the high-security establishments). Approximately 15 prisons held females but these are not equitably distributed. Some regions, such as Wales, had/have no prisons for women.

As noted, work on the wholesale carceral mobilities of prisoners is largely limited to the availability of meaningful data in this area. For example, although MoJ report prisoner population including inflow, outflow and transfers numerically on a monthly basis, the details of specific transfers are held at the individual level in the case management system for prisons (Prison-NOMIS), which has been in place since May 2009.³ Utilising the case management system to extract such data for analysis at the national level would require an unprecedented level of access and unjustified administration time. Perhaps more significant than the feasibility of access is that, in addition, as far as we are aware, such data does not capture the location before and location after residence in prison in a longitudinal sense. Our research goal was to report data summatively to map such journeys to extend them both up to 12 months before and up to 12 months after a prison sentence, which renders the Census a more

² Responsibility for prisons in other UK countries is held by the Scottish Prison Service (SPS) and the Northern Ireland Prison Service (NIPS) in Northern Ireland. HMPPS was created in April 2017 following the merger of the National Offender Management Service (NOMS) and Her Majesty’s Prison Service (HMPS), integrating prison and probation functions under one umbrella organisation. Accordingly, at the time of the census in 2011, NOMS was the responsible body.

³ An “ambitious data-linking programme led by the Ministry of Justice and funded by ADR UK” has recently been made available to allow researchers to chart ‘custodial journeys’ (Ministry of Justice, [34], no page).

legitimate source of data.⁴ Accordingly, in this paper, we draw upon data on current and previous postcode location from the 2011 UK Census to identify and visualise trends in movement into, between and out from prisons in England and Wales.

The British Census has been conducted every 10 years since 1801 to report a wide variety of information on households in the UK. At the time of writing the 2021 results have not been fully released, such that the most recent available census is from 2011, which is the dataset we employ in this paper. In different countries of the UK (England, Wales, Scotland and Northern Ireland) the census is conducted by different authorities. While there is considerable alignment between the regions, the procedures, questions and reporting differ to some extent. In England and Wales, the census is overseen by the Office of National Statistics (ONS) and hence the alignment between English and Welsh data is close enough that the England and Wales census is typically considered as a single dataset. The main body of the census consists of several demographic questions focusing on employment, education, housing, ethnic origin and health issues. Additionally, the census also reports data on the relocation of persons within the UK – here defined as the census flow dataset. This is derived from the question of where a person resided during the night before the census day (here March 27, 2011) and where they resided one year prior to the census day. This so-called census flow data can be used in the study of mobilities of individuals and, in this paper, we deploy this flow data for the first time to consider the carceral mobilities of incarcerated persons.

The census designates Her/His Majesty's Prisons (HMPs) and Young Offenders Institutions (YOIs) as "Communal establishments", rather than households [42]. In communal establishments the census response is typically filed by the management of the establishment and hence the data can be assumed to be highly accurate. Nevertheless, before outlining our methods of data extraction, we first briefly acknowledge details of the census's methodology that impinge on the resolution and accuracy of the census data for the study of mobilities.

Our analysis relies on the assumption that we can locate particular prisons within the census data in order to map the transfers in, out and between these establishments. Our approach recognises that the census data is reported in spatially aggregated areas on different scales: the finest scale offered being the output area (OA) level.⁵ Communal establishments are not broken up into different OAs, but one OA

⁴ A further solution may have been to implement a directed prisoner questionnaire. However, such a national-scale project would require multi-level ethical approval across the estate and represent an arguably unfeasible demand on researcher/establishment time and financial input. The scope of such a study would be limited to inflow and transfer mobilities only, since post-release movements could not be captured.

⁵ The OAs of the 2011 census were defined after the census data collection and are designed such that:

- Each OA contains at least 40 resident households and at least 100 residents
- OAs do not cross boundaries of local authority districts
- OAs are socially homogeneous (i.e., they group similar census responses to the extent possible)
- OAs are contiguous and non-overlapping and cover the whole land area of the UK
- If possible, OA boundaries from the 2011 census are preserved (National Archives, [41])

As the OAs partition the geographic area of the UK into areas with approximately equal number of resi-

may contain multiple HMPs and/or YOIs in close proximity and are therefore forced to acknowledge some overlap in the two instances where establishments are located simultaneously. This has a bearing upon the types of cluster analysis that we were able to achieve. In accordance with the capabilities of our dataset, we classified all prison establishments into either “male” or “non-male” facilities as indicated by the predominant function noted by NOMS. “Non-male” refers to any prison establishment that is not predominantly male. This recognises that, in some locations, prison populations are grouped together on one site. This includes establishments containing females and/or young offenders. However, in these cases, the OA method does not allow us to distinguish which of those multiple possible specific establishments an individual was housed within. We can therefore classify the inferred flows by gender according to the source and destinations of the flows, except in a small number of where prisons with different gender classifications share the same OA (e.g., HMP High Down and HMP Downview).

Moreover, at least 40 residential households are included in any output area containing a communal establishment, so that not every resident of a prison OA is also a prisoner. Therefore, while the census flow dataset offers us a reliable glimpse into prison transfers and the flows into and out of prison, it is important to note that some proportion of the flows from and to the respective OAs may be due to the non-incarcerated residential population in the OA. However, due to the relatively large size and high turnover of prison populations, the majority of these flows and, particularly, the majority of longer-distance flows still likely reflect inflow and outflow of prisons. By comparison, the flow between two OAs containing prisons can be assumed to represent prison transfers, as a non-incarcerated person living in a prison OA is unlikely to move to another location which is also a prison OA. We are therefore confident that the flow data gives us an accurate picture of prison transfers.

A further note is that our method may not provide an exhaustive list of transfers because transfers where the prisoner stayed at the source or destination of a transfer for less than one year are not captured by the census window. Prisoners are considered to be residing at the prison if they have been convicted and are either still awaiting sentencing or are serving a sentence of more than 6 months. This means that persons with sentences of less than 6 months and prisoners on remand are considered to be only visiting the prison.⁶

Extraction of carceral flows

To compile a prison flow dataset, we first determined the 141 prison establishments (HMPs and YOIs) that were functioning in March 2011 by comparing data from various Her Majesty’s Inspectorate of Prisons (HMIP) reports to the list of

Footnote 5 (continued)

dents, the differences in population density result in OAs of very different size. The largest OA is, found in rural Wales, covers nearly 30 km² whereas the smallest output area, in central London, covers only 30 m² (Office for National Statistics, [44]).

⁶ Persons without a permanent residence in the UK are considered residents of the prison regardless of their legal status or length of sentence.

prisons produced by Her Majesty's Prisons and Probation Service (2023). The list provides detailed information on each prison including the NOMS region, predominant function (namely, in relation to the cohort housed [i.e. adult/young offender/male/female] and the security level [i.e. from Category A highest-risk closed prison to Category D lowest-risk open prison]), probation service region, expected resettlement region, security classification and the postcode. We then used the prison's postcode to locate the prison in the census dataset.

The UK postcode is a geographical coordinate system that identifies a point in the UK within an accuracy of a few metres. Postcodes thus provide a geolocation of the prisons, which we converted into geographical (WGS 84) coordinates using the Google Maps API [24]. Outlines of Census Output Areas (OAs) in England and Wales are available from the UK Data Service [63], which allowed us to identify the OAs containing a prison geolocation from its geographical coordinates. As OAs are aggregated demographic units to maximise local homogeneity, the OAs containing a prison are supposed not to contain other residential establishments. In two instances prisons are located in the same OA: HMP High Down and HMP Downview are both located in the OA with the identifier E00170403 and HMP Low Newton and HMP Frankland are both in OA E00105095. Hence the number of prison OAs is 139.

As indicated, we used the census flow dataset [62] to determine the flows to, from and between the prison OAs. Among the prison OAs, 31 do not appear in any transfer flows (see Fig. 1). However, we note that around half of the prisons that do not participate in transfer flows were closed between the census date and 2016 and were likely in a period of reducing capacity at the time of the census. It is also plausible that some of these establishments, such as the Immigration Removal Centres did not contain any individuals who were eligible for census recording. Lack of census return is also a potential explanation, particularly if institutions contained a large number of persons with sentences of less than 1 year in duration. The remaining prisons in Fig. 1 that demonstrate no clear explanation do not disproportionately represent any one category, gender or region. To this end, we are confident that the remaining flow data provides a useful picture of England and Wales.

In the following we therefore analyse the flows between the 108 prison OAs that participate in the flow network. In the remainder of this paper, we operationally consider all flows from a non-prison OA to a prison OA as “prison inflows”, all flows between prison OAs as “prison transfers” and all flows from a prison OA to a non-prison OA as “prison outflows”.

No transfer flows: Blantyre house, Bullwood Hall, Canterbury, Coldingley, Dover, Dorchester, Erlestoke, Everthorpe, Frankland, Glen Parva, Gloucester, Haslar, Holloway, Humber, Kennet, Kingston, Low Newton, Morton Hall, Northallerton, Oak Hill, Pentonville, Peterborough, Portland, Prescoed, Ranby, Rainsbrook, Reading, Shepton Mallet, Shrewsbury, Spring Hill, Wolds.

Don't appear as source: Bristol, Thameside, Wakefield.

Don't appear as destination: Askham Grange.

Fig. 1 List of prison OAs that do not participate in transfer flows

Eigenvector centrality

In the context of analysing prison flows between prisons in England and Wales, the concept of eigenvector centrality was employed to gain insights into the relative importance and influence of individual prisons within the overall network. Eigenvector centrality is a metric of importance that is closely related to Google's PageRank algorithm and is widely used across many different application domains and can be considered as one of the most fundamental tools of network analysis. It builds on the idea that the importance of a node in a network is related to the sum of the importances of its neighbours. By treating the prison flow system as a directed graph, with prisons represented as nodes, and flows between prisons as directed edges, eigenvector centrality provides a quantitative measure of the significance of each prison. We can write this mathematically as

$$x_i = \sum_{j=1}^N \frac{A_{ij}x_j}{\lambda_1}$$

where x_i is the importance of node i and A_{ij} is the sum of flows between i and j and λ_1 is the largest eigenvalue of the matrix of flows A . The scaling by λ_1 is needed, otherwise no solutions exist. The equation can be solved iteratively to find the importance of all nodes. The solution is then also the leading eigenvector of the matrix of flows A , hence the name.

The resulting eigenvector centrality values provide insights into the relative influence and importance of prisons within the prison flow network. Prisons with higher eigenvector centrality scores are those that receive flows from other influential prisons, suggesting their prominent role in shaping the overall flow dynamics.

Self-containedness

As well as exploring the significance of particular prisons within the network, it is of particular interest to interrogate the functions of groups of prisons within the system. In 2011, prisons in England and Wales were separated into 11 geographical regions, which managed the distribution of prisoners across categories and the youth and female estate. Inherent here is the assumption that regional clustering ensures that individuals held by the courts will be incarcerated within close proximity to their previous residence and, if moved within their incarceration period, travel generally to another prison within that region. Accordingly, we measure self-containedness of regions as by the proportion of transfer flows that remain within the region. This can be written mathematically as

$$C_i = F_{i,i} / \sum_{j=1}^N NF_{ij},$$

where C_i is the self-containedness score of region i and F_{ij} is the total flow from region i to region j .

Hence the self-containedness score is the probability that a transfer that starts in region i will be a transfer within the region. Conversely, the complimentary value $L_i = 1 - C_i$ is the probability that a flow starting in region i will be a transfer between regions. Regions with higher self-containedness scores are those that generally receive flows from other prisons within the same region.

Results and discussion

We begin our analysis of prison flows by focussing on the general patterns of carceral mobilities for prisons in England and Wales including the turnover of the estate and patterns of transfer. We then move on to deploy flow data to discuss the centrality of particular establishments and the self-containedness of regions of operation.

Overall turnover

To gain initial understanding of the dataset, the first stage of analysis concerns the overall turnover of individuals in prison (see Table 1). Across all establishments the rate of the outflow is nearly twice the volume of the inflow (non-male factor 2.20, male 1.85, undetermined 1.96), indicating that more prisoners were being released than were incarcerated across the March 2010 to March 2011 period. In a stationary state we would assume that the rate of releases equals the rate of incarceration. The deviation of the data from this expected ratio of 1 is too significant to be explained by random fluctuations and is hence indicative of a significant system change, such as a change in policy. The number of outflows seems surprising given that November 2011 actually marked the point in which the prison population in England and Wales reached its highest recorded level of just over 88,000 persons [58], p. 9). However, population trends also reveal a sharp decline in population just before the analysed flow dates of the census period (27 March 2010 and 27 March 2011) (ibid), which may align with attempts to release prisoners in anticipation of the withdrawal of End of Custody Licences in March 2010. The absolute deadline for prisoner early release under this scheme was 12 April 2010 [31, 32], which may have created a disproportionately large number of outflows at the very beginning of this window

Table 1 Total inflow and outflow from prison inferred from the 2011 census data

	Inflow count	Outflow count
Total	11,866	22,232
Male	11,042	20,474
Non-male	601	1322
Undetermined flows	223	436

(which the census data would not nuance). However, given the criteria for release under this scheme – generally short sentences – it is likely that these individuals would have been released within the census window anyway.⁷ In addition, it is also notable that the number of sentences of 4 years or more has increased since the census period [58]. Shorter sentences are often indicative of more outflow and, since our dataset cannot capture the movements of prisoners who are incarcerated for less than one year, the number of outflows should not be used to indicate wider trends in the prisoner population.

There are also some notable nuances when clustering our establishments into our two predominant functions. Considering the numbers of inflow and outflows demonstrates that there are significantly more male than non-male prisoners (factor 18.37 in inflow, factor 15.49 in outflow) (see Table 1). This overall factor is consistent with their over-representation in the prison population. Female prisoners, for example, represented around 5% of the prisoner population across 2011 [58], p. 17). However, what is notable is the ratio between outflow and inflow for non-male prisoners, which is larger than for male prisoners (2.20 vs. 1.85). While both ratios exceed 1, indicating a greater number of outgoing prisoners, the degree of this excess is more pronounced for non-male prisoners, suggesting a more substantial outflow trend within this group. In general, the female population decreased steadily from the 1900s (17%) until the 1960s (2%) when it began to rise very slightly again to its most recent high of 6% in the early 2000s [1], p. 28). The census period in our analysis falls into the time thereafter 2005 where the trend is reversed, with a steady decline once again observed. In addition, the other non-male populations have also witnessed steady decline. For example, the population of under 21 s (individuals likely housed in YOI establishments) decreased from around 16% of the prison population in 2002 to 4% in 2022 (a decrease of approximately 7000 persons) [58], p. 11). We conjecture that at a time when there may have been strong political pressure to empty prisons, decision-makers felt more comfortable releasing female and young people than adult male prisoners.

Patterns of transfer

As previously noted, a major component of our analysis was to understand how individuals moved around the prison estate. The findings both provide confidence in our method of analysis and reveal nuance about the nature of prisoner transfers in England and Wales. In the first instance, the transfer flows conform to our general expectations, that is the vast majority of transfers illustrate—as might be expected—that individuals move either between male and male, or non-male and non-male establishments (see Table 2). Table 2 also illustrates that by far the most transfers occur between male prisons, indicating the dominant percentage of the male prison population. The second largest transfer flow is between non-male prisons, which is consistent with our plausible expectations that female prisoners and young offenders are moved around different establishments within those types.

⁷ 72% of the 1020 persons released during March to April 2010 were serving sentences of less than 12 months (Ministry of Justice, [31]: p. 1).

Table 2 Transfer flows between prison OAs classified by gender of the prison at the origin (rows) and destination (columns)

o/d	Male	Non-male	Unknown
Male	6240	3	55
Non-male	30	136	17
Unknown	32	14	5

Classification is unknown if flows start/terminate in an OA containing multiple prisons of different gender classification

The results also illustrate that 30 transfers occurred from non-male to male prisons. It is likely that this number is largely explained by young offenders ‘ageing out’ of dedicated youth facilities at the age of 21 and being transferred to the adult estate. Indeed, we can confirm that 25 of these transfers originated in OAs containing YOIs.

Perhaps, more surprisingly, is the observance of three transfers from male to non-male establishments and five transfers from non-male to male transfers that did not originate at YOIs.⁸ This small number of transfers is possibly explained by prisoners changing gender identity. If we follow this hypothesis utilising data from the 2021⁹ where 0.5% of the population of England and Wales responded that their gender identity does not match their sex assigned at birth, we actually find these assumed types of transfer to be below the level of expectation. Assuming that 0.5% of people change their gender identity at a random point within the typical span of 80 years gives us a probability of 0.00625% that a given person changes their gender identity in a given year. Multiplying this with the number of prisoners in England and Wales in March 2011 (84,905) gives us an expected number of 5.31 gender changes in the prison population per year. Accordingly, the transfers we report are at the same scale of transgender frequency in the UK.

We also analysed transfer flows according to the security classification to which prisons in England and Wales are assigned. There are four alphanumeric categories ranging from A (most secure) to D (open prisons). Category B (local) prisons house prisoners that are taken directly from court (sentenced or on remand) meaning that, generally, all prisoners typically begin their prison journey in a prison of Category B status. After sentencing, the prisoner then is assigned to a security category depending on the severity of their crimes and personal circumstances. Some prisoners

⁸ It is also interesting to note that all five non-male to male transfers that did not originate at YOIs all came from HMP Send: a female prison. Furthermore, two of the three male to non-male transfers led to HMP Send. It seems an odd coincidence that most of the transfers that appear to record a change in gender revolve around one prison. Hence an alternative explanation may be that some male prisoners were held at HMP Send during the census period for some reason. However, we have been unable to discern any probable cause from various establishment and inspectorate reports. There is a small chance that, due to the OA construction, the census data would record movements of non-prison residents living in the immediate vicinity of the establishment. However, it seems equally implausible that an individual would move from one household located directly proximate to a prison to another property located directly proximate to another prison. Prison Officer accommodation may have explained such movements in the past but NOMS did not provide accommodation of this nature in 2010–2011.

⁹ The 2011 census data only included a binary response to the gender identity question. The 2021 census was the first to employ a question where other gender identities were recognised and we therefore use this figure as a general comparator.

Table 3 Transfer flows by security classification of the prison at the origin (rows) and destination (columns)

o/d	Cat. A	Cat. B	Cat. C	Cat. D	Unknown
Cat. A	69	106	53	2	52
Cat. B	139	760	480	53	243
Cat. C	180	1379	688	43	311
Cat. D	5	126	442	32	101
Unknown	64	414	399	7	384

Classification is unknown if flows start/terminate in an OA containing multiple prisons of different gender classification

remain in their initial prison if its training programme allows but are more likely to move. Indeed, most prisoners are housed in Category C establishments (Ministry of Justice [36]).¹⁰ The security classification allows us to categorise flows according to the security at the source and the destination, except in cases where prisons of different security classification share an OA.

The table of flows by security classification (Table 3) holds a number of surprises. One would expect that prisoners tend to move to less secure facilities as they are nearing release. However, such a trend toward Categories C and D is not evident in the transfers. Instead, the largest volume of transfers takes prisoners from the Category C to the more secure Category B. In Category B, most transfers then occur within the category. By contrast, when considering the open prison Category D, only 32 transfers remained in this category, while 442 led to the more secure and closed Category C and a further 126 led to the even more secure Category B. Overall there is a strong trend that take prisoners to more secure categories over time, leading up to B.

The only exception to the upwards trend in security is the most secure Category A, which is reserved for male prisoners who, if they were to escape, pose the most threat to the public, the police or national security. Most transfers from this category take prisoners to a Category B prison. The data indicates only two transfers from Category A to the open category D (Manchester to Ford, Full Sutton to Thorn Cross), representing merely less than 1% of known transfers from the Category A estate. This is interesting given that, although Category A prisoners are eligible for re-classification to Category D status after 2 years of their sentence, there is little evidence to indicate that this status is achieved.

The geographies of prisoner flow

A significant point of interest is the scope and shape of the prison flow network. Long distance movement to prisons and in transfers between them puts an undue strain on prisoners as they make it harder to maintain social relationships to the outside world and thus reduce chances of successful reintegration of prisoners into

¹⁰ We do not expect to see these initial transfers that take place immediately after conviction in the dataset as prisoners on remand would be considered to be ‘visiting’ the prison for census purposes except in special circumstances (such as holding foreign national status).

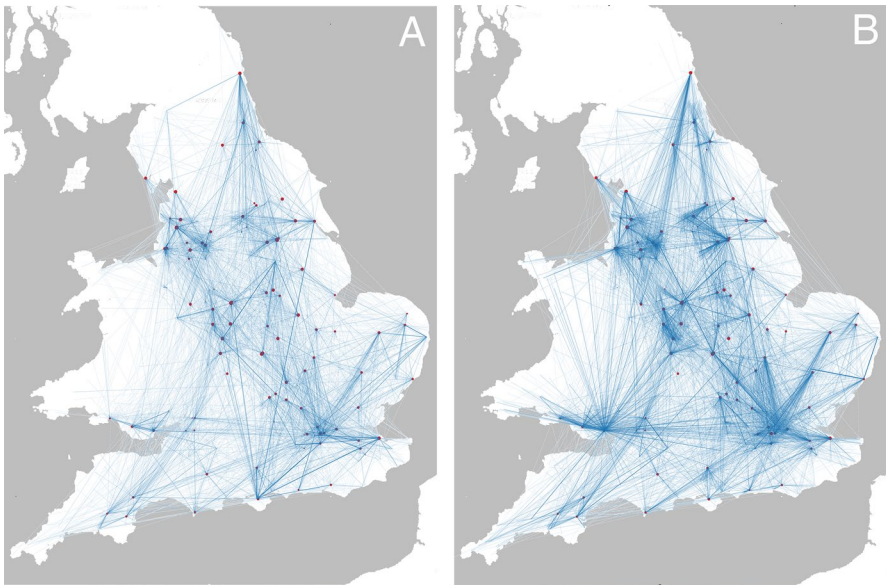


Fig. 2 Inflow (A) and outflow (B) movements to and from prisons in England and Wales. Prisons are shown as red dots while prisoner movement is represented by blue lines. As the movement leads into or out of prison each line has one endpoint which is a prison and one which is not

society [5, 7, 15, 30, 38, 55]. Therefore, following our initial stages to establish the broad patterns of prison flow according to function and security classification, we turn to the implications for such flows upon the wider geographies of the prison system in England and Wales: namely the centrality of particular establishments and the operation of its regions.

Centrality in the flow network

Plotting prisoner movements reveals their organisation as a complex network with even visual analysis clearly indicative of the presence of movements that map onto key urban centres. Figure 2 depicts the geographies of prison inflow (2a) and outflow (2b), which provides a clear illustration of the dominance of certain prison establishments within England and Wales and the sheer range of locations from which prisoners are received from and then released to. Comparing these networks shows a much denser network for the outflows, which is partly caused by the aforementioned higher number of releases compared to receptions in the census window. However, it is also apparent that some prisoners travel long distances upon release and relocate in large urban centres, particularly London

and Manchester. This is reinforced by analysis of the distance prisoners travelled across the two census dates (see Fig. 3).¹¹

This effect can also be visualised by plotting a Sankey diagram (see Fig. 4). Whereas most of the inflows, transfers and outflows stay in the respective census region, the London area attracts a significant number of persons released from prisons elsewhere, significantly outnumbering those released from London prisons. We interpret this as a sign that at least some proportion of released persons are attracted to the greater opportunities and/or anonymity offered by large urban centres.

The London region is not equally apparent when considering prisoner transfers. Although the concentration of prisons and transfers near urban areas is not surprising, the density of transfers is noticeably higher in the Midlands than it is in London (see Fig. 4, and see Fig. 5 for a map of centrality). Analysis reveals a complex network with tight connectivity, with densely connected hub regions near the major urban areas of London, the East Midlands, Birmingham and Leeds. Moreover, this focus on the midlands is confirmed when we determine the most central establishments in the prison network. The most central prison in the transfer network is HMP/YOI Moorland, situated near Doncaster and Sheffield, followed by HMP/YOI Wyemott, between Preston and Manchester, and HMP Dovegate, between Derby and Stoke-on-Trent (see Fig. 6). Indeed, all of the top-10 most central prisons lie in (or at least very near to) the Midlands area of the UK, which further highlights its role as the hub region of the prison network.

Such findings are interesting because such an analysis reconfigures thought on which prisons within the estate in England and Wales may be considered the most ‘important’. In particular, with the exception of HMP Birmingham (revealed as the 4th most central and 4th most populated establishment), the 10 most central prisons do not correspond with the 10 most populated prisons in the system in England and Wales in March 2011 [33]. This type of reconfiguration may prove useful to discussions around the redevelopment of the prison estate. Presently, around a quarter of prisoners in England and Wales are held in Victorian establishments, which are often criticised for their challenges to living standards and their capacity to deliver activities congruent with contemporary sentence planning (Ministry of Justice, 2021, p. 12). However, simultaneously such institutions are recognised as highly populated with a persistent rhetoric emergent around the crucial role that such prisons play within the estate [52]. Nevertheless, analysis of carceral mobilities does offer a differing analysis of which prisons may indeed be crucial to the functioning of the system. However, further analysis that would also recognise the flow of prisoners on remand and shorter sentences would be necessary here given that the most populated prisons often house this category of person.

¹¹ The inflow distance is likely to be lower than outflow distance because prisoners likely to be captured by the census would have been predominantly located in Category B “local” prisons in the early parts of their sentences. Prisoners with sentences longer than the 6 months that would enable them to be captured by the census would be moved to other prison establishments in accordance with their sentence plan or a recategorisation. These prisons (particularly Category D “Open” prisons, of which there are fewer nationally) are often located in areas outside of central urban areas, offering potential to increase distance travelled from final prison establishment to non-prison location.

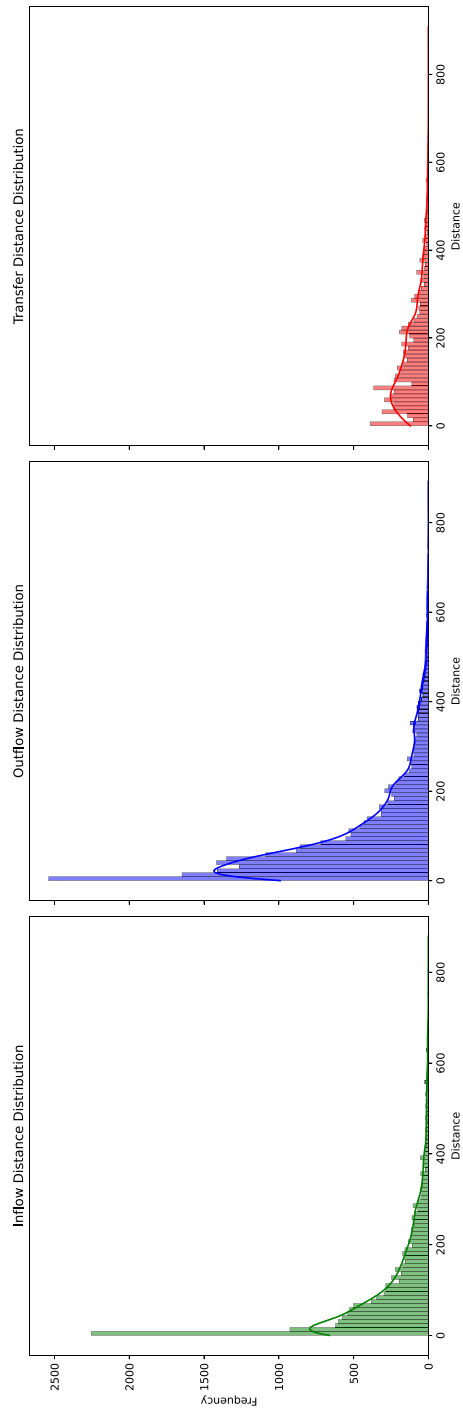


Fig. 3 Distance travelled for inflow, outflow and transfer

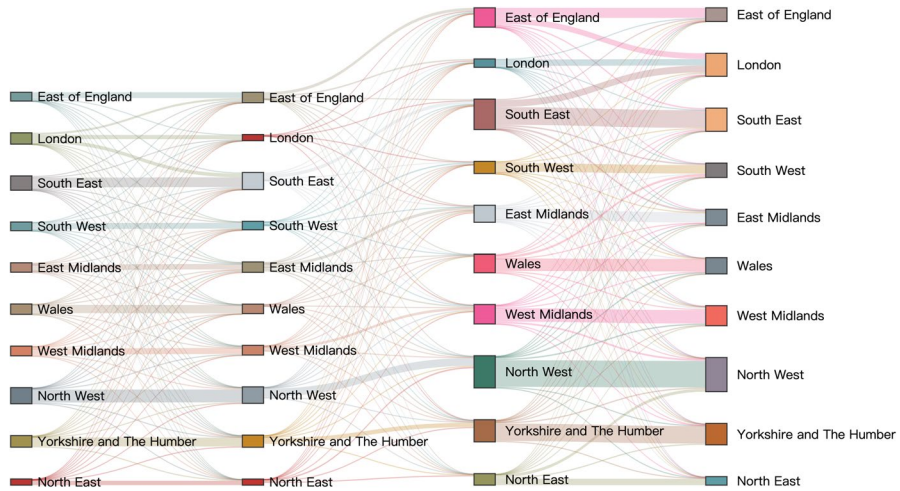


Fig. 4 The Sankey diagram of prison transfers grouped by Lower Layer Super Output Areas (LSOA). The left column is the prison inflows, the medium column is the prison transfer flows, and the right column is the prison release flows. Note particularly the strong gains of London upon release and the relatively strong transfer flows into the midlands and North West

Gendered geographies of flow

A significant concern is that non-male prisoners may suffer from longer distance moves upon imprisonment, transfer and release, due to the lower number of female prisons and establishments for young people. The census data confirms that this is indeed the case. The average distance that non-male prisoners travelled to reach their first prison was 106 km compared to 98 km for males. After release, the average distance for non-male prisoners was 110 km, compared to 101 km for male prisoners. In addition, transfer distance may also be exacerbated in some regions where there is no establishment for female prisoners at all, such as South Central or Wales. Indeed, scrutinising the transfer flows does support inequality in the transfer distances for male and non-male prisoners. Table 4 demonstrates that the prisoners we categorised as “non male” travel slightly longer distances than male prisoners, by approximately 7%. Non-male prisoners were transferred by an average of 166 km compared to 154 km for male prisoners. These findings are consistent with the House of Commons Annual Inspection Report 2011–2012, which highlights the longer distances women prisoners must travel to reach their first prison, the prison to which they are transferred, and their post-release destination.

While there is thus a systematic difference its magnitude is relatively small, amounting to less than 10% of the respective distances. Given the highly disproportionate number of prisons for non-males across the estate, probability around normal distribution would actually predict a much starker difference in the distance travelled. This is possible because neither the population nor the prisons are distributed randomly but does seemingly indicate that the number of prisons for non-male prisoners is sufficient to cover major population centres. However, given the smaller

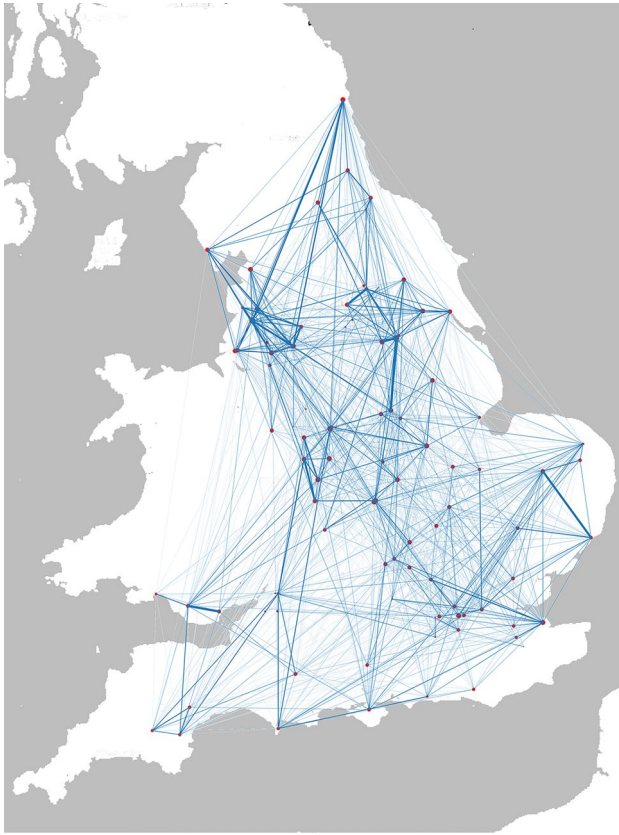


Fig. 5 Prisoner transfers in England and Wales. Here, we plot the prisons as red dots and transfers as blue lines connecting them. Larger dots represent more central prisons in the transfer network whereas stronger lines represent a higher volume of transfers between the connected prisons

population numbers within these functional categories, it is also prudent to consider the performance in marginal and extreme cases. For example, we could imagine that female prisoners from rural communities may be experiencing even longer distances to prison than male prisoners from similar geographical locations.¹² To this end, it is vital that the Ministry of Justice consider the provisions for familial connections and resettlement services for prisoners, and in particular non-male prisoners, being located in prisons beyond the average distance travelled for that functional category.

¹² Another concern is the very long average distances of the non-gender-preserving flows (cf. Table 6). Transfers between a non-male and a male prison are on average 216 km long, whereas transfers from male to non-male prisons are on average 184 km long. We interpret this as evidence that prisoners changing their gender identity and youths entering the male classification are suffering from significantly longer transfers. Given the large number of male prisons and the shrinking prisoner population we are not able to identify good reasons why particularly the non-male to male transfers would need to be this long.



Fig. 6 The 10 most central prisons in England and Wales. Here, we plot the prisons as blue dots, with the numbers representing the order of their centrality

Table 4 Transfer flow distances by gender of the prison at the origin (rows) and destination (columns)

	Male	Non-male	Undetermined
Male	154.44	184.35	150.51
Non-male	215.67	166.35	102.69
Undetermined	113.32	72.61	0.00

Classification is unknown if flows start/terminate in an OA containing multiple prisons of different gender classification

Flow in accordance with the regional structure of the prison system

One factor that should reduce the need for long distance, at least for adult male prisoners, lies in the internal organisation of the HMP system. The prison system in England and Wales is divided into geographical regions, which operate semi-autonomously whilst remaining under wider NOMS/HMPPS regulation. Each of the regions consist of several prisons of different functionalities to conceive, for example, transferring a prisoner to a different security-categorised or age-specific

Table 5 The self-containedness; and inflow and outflow numbers and distances for the regions of operation in England and Wales

Region of operation	S	Number of new prisoners	Average distance in (km)	Number of released prisoners	Average distance out (km)
East Midlands	0.13	1163	121.97	1897	114.51
East of England	0.27	1112	130.44	2108	127.32
Greater London	0.41	891	80.32	1288	74.40
Kent & Sussex	0.22	778	108.09	1398	99.34
North East	0.19	679	110.25	1276	163.50
North West	0.33	1606	86.30	3187	78.31
South Central	0.13	445	91.03	961	92.95
South West	0.18	949	142.52	1350	145.27
Wales	0.81	1004	46.54	2035	117.87
West Midlands	0.36	1037	102.29	2124	89.05
Yorkshire & Humberside	0.29	843	102.99	1770	90.22

The self-containedness S is the probability that movement which originates from a region will remain in the respective region

establishment as they progress through their sentence. This appears to suggest that, in principle, sentenced prisoners should be able to serve the duration of that sentence within the region in which they were first detained (which is likely to be proximate to their home address given the first prison establishment is determined by the court in which the prisoner is tried). To explore the self-containedness of each of the HMPS regions, we computed the probability that a transfer that starts in a region remains in that region (see Table 5).

If the need for prisoner transfers can be achieved within a small geographical radius, we can say the local functionality of a region's prisons is well-established. We note that, overall, the self-containedness of regions is relatively low with all regions exhibiting an average probability of 30% that transferred prisoners remain within the region. The stark outlier is the Wales region, which retains 81% of its incarcerated population within the region (see Table 5). This is interesting to note because, although the Wales region itself represents one of the largest geographical areas, it still retains the majority of its prisoners. This may be explained by, for example, the need to provide bilingual English and Welsh language support and/or the region itself being comprised of a small number of establishments clustered together within relative proximity in south Wales. Accordingly, prisoners within the Wales region travel on average significantly fewer kilometres to their inflow prison than in other regions.

The lowest self-containedness scores are found in the South Central and East Midlands regions, where the probability that a transfer remains within the region is only approximately 13% in each case. South Central contains a high number of YOI establishments, including HMYOI Aylesbury, which is one of the few 'distinct' establishments for solely young people aged 18–21 or 18–24 (as opposed to young people and adults combined) [50]. The disproportionate number of establishments

housing young offenders in South Central may be significant here given that the transfer patterns of young people in custody are generally more complicated than individuals housed within the adult estate. In the first instance, there are fewer YOI establishments across the country, resulting in longer transfer distances in general for those individuals. In addition, there are also very few of the types of establishments that young persons might be housed in before they reach the age of 18 (such as Secure Training Centres (STC) or Secure Children's Homes (SCHs)) resulting in a potential increase in the inflow distance and the likelihood that the inflow to the HMP estate occurred from outside of the region of operation. The East Midlands region may generate low self-containedness on account of similar functional challenges. In the case of East Midlands, there is no designated "high security" prison, which result in the need to transfer out prisoners of this category out to other regions and, similarly, see these prisoners return from other regions as they are re-categorised and require the support of resettlement and training prisoners closer to their last-known address and/or family connections. In general, the low functionality of certain regions of operations is usually highlighted by longer transfer distances and longer distances to and from penal establishments. As previously noted, distance from 'home' and family communities is found to have a bearing upon the lived experience of incarceration and is found to have been influential in aspects such as prisoner (mis)conduct [27].

Conclusion

In this article, we respond to the widespread recognition that carceral mobilities – for example, the variation and scale of the movement of prisoners to, from and around a prison estate – has a bearing upon lived experiences, including likelihood of reoffending and ability to maintain meaningful societal connections, among others. Accordingly, we introduce the use of census flow data to analyse prisoner inflows, transfers and releases to contribute to the scant existing empirical material on carceral mobilities. We examine the accuracy of the extracted prison flow data by comparing it to existing knowledge of prisons and conclude that the data set is an appropriate vehicle for analysis of (particularly long-term) prisoner mobilities in the complete absence of or lack of public availability of other data sets concerning such movements. This provides significant opportunity for further analysis of prison inflows, outflows and transfers particularly across census dates and we call for exploration of the potential of other large-scale data sets to answer key questions about prison establishments internationally.

By deploying the census data using our methods of flow extraction, eigenvector centrality and self-containedness, we map the functionality of prison systems according to gender and security classification, and in relation to the regional governance model of prisons in England and Wales. In general, we report a higher number of outflows than inflows across the census window (March 2010 to March 2011). Whilst we recognise concerns that the method of flow extraction cannot account for the mobilities of prisoners sentenced to less than 12 months, data nevertheless reveals a higher proportional outflow from "non-male" prisons, indicating a general

tendency towards decreasing the population of young people and women rather than their male counterparts. Our analysis of inflow, transfer and outflow distance, for example, observes that although inflow and outflow patterns generally mirror the wider urban-centric population geographies of England and Wales, they also provide further evidence of this disproportional treatment by revealing a clear disparity in the length of mobilities of prisoners outside of the “male” category. This certainly seems to further evidence the disproportional – in general, poorer – treatment of women and prisoners in specialist categories who are also often similarly unequally distributed (see, for example, [8, 46]).

As an attempt to explore the nuances of flows around the estate, we also proposed the self-containedness index, which provides an insight into the overall structure of the prison system and the flows of prisoners between different facilities with the potential to help ensure that the prison system is efficient, effective and safe for both staff and prisoners. In 2011, we observed a generally-low level of self-containedness across all regions other than Wales. This indicates that, whilst this regional structure may have been useful for governance – perhaps from the perspective of finance management or delivery of pre- and post-prison logistics such as court services and probation services – the regions were considerably connected, at least in terms of the transfer of prisoners themselves. Most of the regions of operation require frequent interactions with other regions, potentially indicating the need for new prison construction in these areas or a different management of existing sites. In terms of its contribution to policy and praxis, the self-containedness index can therefore usefully help to evaluate the effectiveness of measures aimed at reducing the movement of prisoners across regions, if that is indeed the Ministry of Justice’s goal. At the very least, it can generate understanding of flow patterns to assist policymakers in identifying potential areas for improvement and to better allocate resources to manage prisoner movements if the regional connectedness is either permissible or even desired.

It is interesting to note that, in 2017 the National Offender Management Service (NOMS) became Her Majesty’s Prison and Probation Service (HMPPS) resulting in the reconfiguring of the regions of operation. This included the adoption of a functional group structure for management of some of the estate, including for example a ‘young people’ category and a separate structure for the management of women. Our data certainly supports the need for such a remodelling. HMPPS reported clear intentions to create a more holistic system whereby individuals sentenced by the courts could be better managed in terms of their whole custodial ‘journey’ – from court, to and through prisons, and upon release via probation services. The renewed regional model would purportedly enable the provision of a more cohesive structure of care across the linear sentence, with a particular focus on inflow, including, for example, the “bus to bed” stage of the prisoner experience from entry to custodial setting (NOMS, [43], p. 15). *The National Offender Management Service Annual Report and Accounts 2016–2017* outlines a strong philosophy for a renewed HMPPS under its new managerial structure, with the renewed regional model a crucial component of its delivery. A worthwhile advancement of the current study would therefore be to compare regional self-containedness scores using the 2021 census data, once available. Such comparison may also reveal the impact of the opening of new,

very large establishments such as HMP Five Wells in Wellingborough, Northamptonshire and HMP Fosse Way in Glen Parva, Leicestershire.

These new establishments were a result of the 2016 Prison Estate Transformation Programme (PETP), which paralleled the shift from NOMS to HMPPS and intended to build 10,000 ‘new for old’ prison places (NOMS [43]). PETP also included a strategy to reconfigure the categorisation of adult male prisons, which had clear intentions to “reduce surplus local prison places and increase category B training places, category C capacity and access to resettlement places to ensure there is a sufficient supply of suitable prison places to meet demand” [3], p. 9). Again, our analysis of prisoner transfers justifies such decision-making, with flow data revealing a number of discrepancies with the expected practices of prison category transfer. Our eigenvector centrality was employed to gain insights into the relative importance and influence of individual prisons within the overall network, from which we hoped to provide potential understanding of whether potential surplus places could be indicated. It is certainly interesting to note that the majority of our ten ‘most important’ prisons do not mirror the ten ‘most populated’ prisons in England and Wales in March 2011. However, given our methods cannot capture the movement of short-term prisoners – i.e. those who would predominantly be housed in ‘local’ institutions – we cannot offer concrete suggestions to identify surplus institutions at this stage. The findings may again indeed be advanced pending further comparison with 2021.

Finally, the approach outlined in this paper makes a clear intervention into the carceral mobilities literature, moving beyond generalised institutional data (i.e. population figures per institution or number of transfers across the whole estate) to offer a feasible method to explore the specific geographies of prisoner inflow, transfer and outflow. This technique mitigates the challenges of availability and access to institutional data, and allows for a more comprehensive narrative of movements to and from prison spaces, which would demand considerable cross-institutional negotiations. Aside from illustrating nuances around differing patterns across categories, genders and regions in relation to patterns and distances of movement, our approach itself reveals much potential for future development of the disciplinary area. Having identified an appropriate method to interrogate distance to incarceration, for example, we are now able to move forward with further work to triangulate findings in this area in relation to other reported institutional data, such as number of visits or other safety in custody statistics, such as assault or self-harm. In doing so, we can therefore contribute to key questions within carceral mobilities that seek to understand the impact of movement in incarceration upon the experience of life in prison.

In conclusion, the analysis of census flow data in this study offers the first substantial insights into the carceral mobilities related to prisons according to their function and the security status of prisoners, drawing on the case study of England and Wales. The approach here not only offers a significant advance in the methods available to carceral scholars in mapping and modelling the movements of prisoners within a given estate, but also reveals an inherent ability to highlight patterns of movement distinct to individuals of particular category. In revealing discrepancies and disproportional experiences around, for example, distance travelled and regional

connectedness, such an approach can offer a vital tool for the measurement of efficiency and effectiveness of the management structure of prisons more broadly.

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Data availability The Output-Area-level flow data is the Origin and destination of migrants, MF01UK is available from Office for National Statistics, UK Data Service. The prison information is available from the government website of HM Prison Service and the research report, *The prison estate in England and Wales*, from UK Parliament's House of Commons Library. The geocoordinates of the prisons was mapped from the prisons' postcode by Google Maps API.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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