



Prison Population Projections 2017 to 2022, England and Wales

This bulletin presents prison population projections for England and Wales from August 2017 to March 2022. It is produced to aid policy development, capacity planning and resource allocation within the criminal justice system (CJS) and Her Majesty's Prison and Probation Service (HMPPS).

Main points

An increase in the prison population is forecast over the horizon to March 2022.



The prison population is projected to remain stable in the period to June 2019, but then to increase to 1,600 places above the current level in March 2022.

Projected population growth concentrated in offenders sentenced to longer sentences.



Growth in the determinate sentenced population is expected due to recent trends in offender case mix, with more serious cases coming before the courts resulting in longer custodial sentences. This increase is outweighing decline in indeterminate sentenced population, following abolition of IPP sentences in 2012.

2017 projection higher than 2016 projection



The higher projection reflects increases in custody rates and sentence lengths for indictable offences offsetting declines in numbers of offenders sentenced. There has also been growth in the remand population above expected levels.

Over 50, over 60 and over 70 year old populations are projected to rise



The rise is driven by the recent increase in the number of longer sentences for these. These increases are predominantly driven by prior shifts in the offence mix of prisoners flowing into prison – specifically increases in sexual offending.

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Introduction

This bulletin presents prison population projections for England and Wales from August 2017 to March 2022. It is produced to aid policy development, capacity planning and resource allocation within the criminal justice system (CJS) and the HM Prison and Probation Service (HMPPS). The latest published useable operational capacity (18 August 2017) is 87,201¹.

The projection is produced using a model of flows of offenders into and out of prison which counts the resulting prison population each month. It is based on assumptions about future custodial convictions and incorporates the anticipated impacts of agreed policy and procedural initiatives. It does not, however, attempt to estimate the impact of any future Government policy that is yet to achieve Royal Assent, and therefore becomes less certain over time.

The latest statistics and commentary on the current and historic prison population are published in the Offender Management Statistics Quarterly publication. This is available online on GOV.UK at: www.gov.uk/government/collections/offender-management-statistics-quarterly

The Story of the Prison Population provides a summary of what happened to the prison population between 1993 and 2016 and the major factors contributing to these changes: www.gov.uk/government/statistics/story-of-the-prison-population-1993-to-2016

¹ www.gov.uk/government/statistics/prison-population-figures-2017

1. The 2017 total projection and custody type breakdown

The prison population was 86,388 as of Friday 18th August 2017. It is projected to remain stable to June 2019 but then increase by 1,600 places above the current level to 88,000 in March 2022.

In the period to June 2019 projected growth in the determinate sentenced and recall populations is offset by projected declines in the indeterminate population. Over the full projection horizon to March 2022 growth of the determinate sentenced population, driven by increased severity of offence mix, results in projected net population growth.

Figure 1.1: Total prison population projection, August 2017 to March 2022 (Source: Table A5)

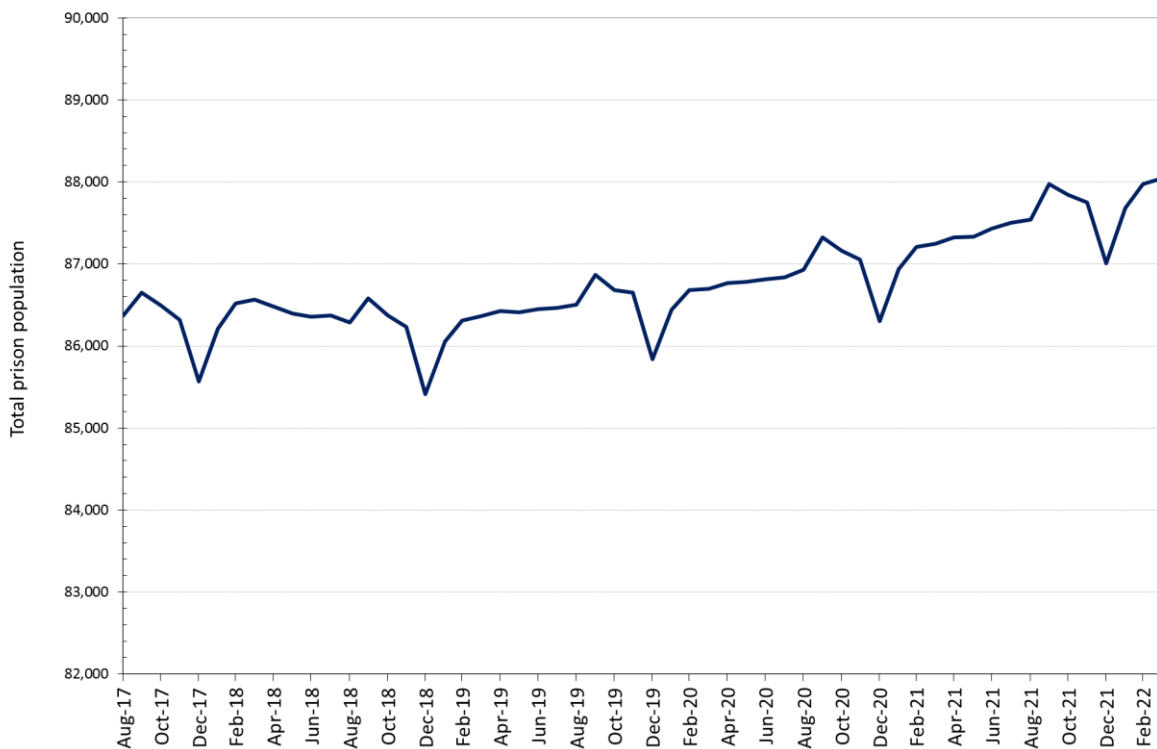


Figure 1.1 presents the prison population projection from August 2017 to March 2022. In the medium term to summer 2019 the population is projected to grow only marginally as growth in the sentenced determinate population is offset by projected declines in the indeterminate population. The rate of projected growth in the sentenced population is lower in this period as court disposals are expected to decline to match levels of incoming court receipts. Future proportions of sentenced offenders going to custody, and their sentence lengths, are assumed constant based on 2016 data.

In the longer term, underlying growth in the population of offenders sentenced to longer-determinate terms (e.g. of 4 years or more), outweighs declines in indeterminate population, resulting in a projected net growth.

Underlying growth in the determinate sentenced population is expected due to recent trends in offender case mix, where more serious cases (for example, sexual offences, more serious drug offences) have come before the courts. This results in offenders receiving longer custodial sentence lengths, which in turn places an upward pressure on the prison population. Growth in the sentenced determinate population serving custodial sentences of 4 or more years further reflects the abolition of Sentences of Imprisonment for Public Protection² (IPPs) and the resulting increase in offenders receiving longer determinate tariffs, including those sentenced to Extended Determinate Sentences³ (EDS).

Table 1.1 presents the prison population projection at a sub-population level, measured at an end of June position. June is typically a stable point that allows robust year on year comparison. Seasonal shifts in population (shown in Figure 1.1) reflect typical historical shifts in population levels observed in each month relative to underlying level or trend - typically associated with patterns of working days which impact on offender flows through the CJS.

Table 1.1: Total prison population and by type of custody at June 2017 and projections for June 2018 to June 2021

	Total	Remand	Determinate	Indeterminate	Recall	Non-Criminal⁴	Fine
June 2017	85,863	9,638	57,726	10,600	6,390	1,422	87
June 2018	86,400	9,900	58,800	9,700	6,500	1,400	100
June 2019	86,500	9,900	59,300	9,100	6,700	1,400	100
June 2020	86,800	9,900	59,900	8,700	6,800	1,400	100
June 2021	87,400	9,900	60,700	8,300	7,000	1,400	100

*Figures may not sum due to rounding of projected figures to nearest 100

The indeterminate population is projected to continue declining over time. The indeterminate population consists of those offenders who continue to serve Sentences of Imprisonment for Public Protection (IPPs) and life sentences. As a result of the abolition of the IPP sentence in 2012, offenders can no longer receive these sentences. IPP prisoners are only therefore being released or recalled. All indeterminate recalls are counted in the recall projection.

The Recall population⁵ is projected to increase above current levels. Reasons for declines in non-indeterminate recalls observed since 2016 are not yet fully understood hence these are

² Sentences of Imprisonment for Public Protection (IPPs) were created by the Criminal Justice Act 2003 and started to be used in April 2005. Offenders sentenced to an IPP are set a minimum term (tariff) which they must spend in prison. After they have completed their tariff they can apply to the Parole Board for release. The Parole Board will release an offender only if it is satisfied that it is no longer necessary for the protection of the public for the offender to be confined.

³ Extended Determinate Sentences are sentences for dangerous criminals convicted primarily of serious sexual and violent crimes with no automatic release from prison halfway through their sentence. The offender will either be entitled to discretionary release at the two thirds point of the custodial sentence or be entitled to apply for parole from that point. If parole is refused the offender will be released at the expiry of the prison term.

⁴ Non-criminal prisoners are held for civil offences or under the immigration act. A civil non-criminal prisoner is someone who is in prison because of a non-criminal matter, for example, non-payment of council tax or contempt of court. The non-criminal population also includes immigration detainees that have finished serving their sentence and are being kept in prison by immigration authorities or those detained in HMPPS operated Immigration Removal Centres (IRCs).

projected at current levels. Projected growth is driven by an expected further release of IPP offenders and subsequent recall of some of those offenders to custody.

Further changes in the prison population are expected as the result of a range of policies, including those already in effect but not yet fully represented in the population and those expected to take effect over the projection horizon. The projections only take into account the impact of government policies which have achieved Royal Assent⁶. These include:

- The impacts of the Criminal Justice and Courts Act 2015 which includes provisions for restricting the use of cautions; changes to the framework for the sentencing and release of serious and dangerous sexual and violent offenders; and the introduction of a new test for the release of recalled determinate sentence prisoners⁷;
- The impacts of the Serious Crime Act 2015 which includes provisions for additional caseload and associated custodial sentences relating to new offences for controlling or coercive behaviour in an intimate or family relationship⁸;
- The expected impacts of the Sentencing Council guidelines on reduction of sentence for early guilty pleas⁹;
- The impacts of the current Prisoner Transfer Framework allowing the UK to deport and receive prisoners to and from other EU member states¹⁰; and
- That following the Release on Temporary Licence (ROTL) review in January 2014, all offenders who have previously absconded are no longer returned to the open estate or released on temporary licence except in exceptional circumstances.

⁵ Offenders are released from custody under licenced supervision, subject to a set of conditions such as living at an approved address. If the offender breaches the conditions of their licence they may be recalled into prison.

⁶ Once a bill has completed all parliamentary stages, it is ready to receive Royal Assent. This is when the Queen formally agrees to make the bill into an Act of Parliament (source: <http://www.parliament.uk/about/how/laws/passage-bill/lords/lrds-royal-assent/>)

⁷ <https://www.gov.uk/government/publications/criminal-justice-and-courts-bill-impact-assessments>

⁸ www.gov.uk/government/uploads/system/uploads/attachment_data/file/370943/Serious_Crime_Bill_-_Overarching_Impact_Assessment_-_Commons_Intro.pdf

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/393814/Impact_Assessment_-_Strengthening_the_Law_on_Domestic_Abuse.pdf

⁹ <https://www.sentencingcouncil.org.uk/wp-content/uploads/Guilty-plea-resource-assessment.pdf>

¹⁰ www.gov.uk/government/uploads/system/uploads/attachment_data/file/326699/41670_Cm_8897_Print_Ready.pdf

2. Uncertainty in the projection

There is a 20% likelihood that the prison population will reach or exceed 87,600 and only a 5% likelihood it will reach or exceed 88,900 in June 2018. There is a 20% likelihood that the prison population will reach or exceed 89,700 and only a 5% likelihood it will reach or exceed 91,800 in June 2021.¹¹

The likelihood of the prison population falling within ranges around the projection is estimated based on performance of previous prison population projections.

The Prison population projections are informed by the latest available published data. They also reflect assumptions – accounting for the best available evidence at the time – as to future levels and trends in CJS process flows, sentencing outcomes and other uncertain policy impacts yet to come into effect. Unanticipated changes to government policy, as well as offender, police and sentencer behaviours, will inevitably mean the actual prison population in future years will differ to some degree from projections.

The underlying forecasting methodology has not changed significantly since 2008 (see Technical Guides below for details). Assuming that the drivers of the prison population have not become inherently more volatile or unpredictable, it is possible to use the performance of previous projections (e.g. measures of actual population relative to projected levels) to estimate likely ranges of the future prison population relative to the current projection.

Based on the performance of previous projections, 12 months after publication the actual population is expected to be within 1.5% of the projection, either way, 60% of the time. After 48 months the actual population is expected to be within 2.5% of the projection, either way, 60% of the time.

Figure 2.1 shows the 2017 projection as a solid line. This is interpreted as the single most likely population projection, given available data and the agreed set of assumptions. Around the projection are three bands indicating ranges and likelihood of population outturn. These bands reflect the scale of historical deviations relative to previous published projections. Ranges with 30%, 60% and 90% likelihood of bounding actual future prison population are shown.

Table 2.1 shows the same uncertainty ranges around the current projection expressed as likelihood that population will reach or exceed that level. There is a 20% likelihood that the prison population will reach or exceed 87,600 and only a 5% likelihood it will reach or exceed 88,900 in June 2018. There is a 20% likelihood that the prison population will reach or exceed 89,700 and only a 5% likelihood it will reach or exceed 91,800 in June 2021.

¹¹ June figures are reported as a stable in-year position not subject to seasonal trends. This allows comparison of underlying population level between years. It is possible that the population projection exceeds these levels between June figures presented (see Figure 1.1 for seasonal pattern).

Figure 2.1: Uncertainty in 2017 total population projection, August 2017 to March 2022 (Source: Table A7)

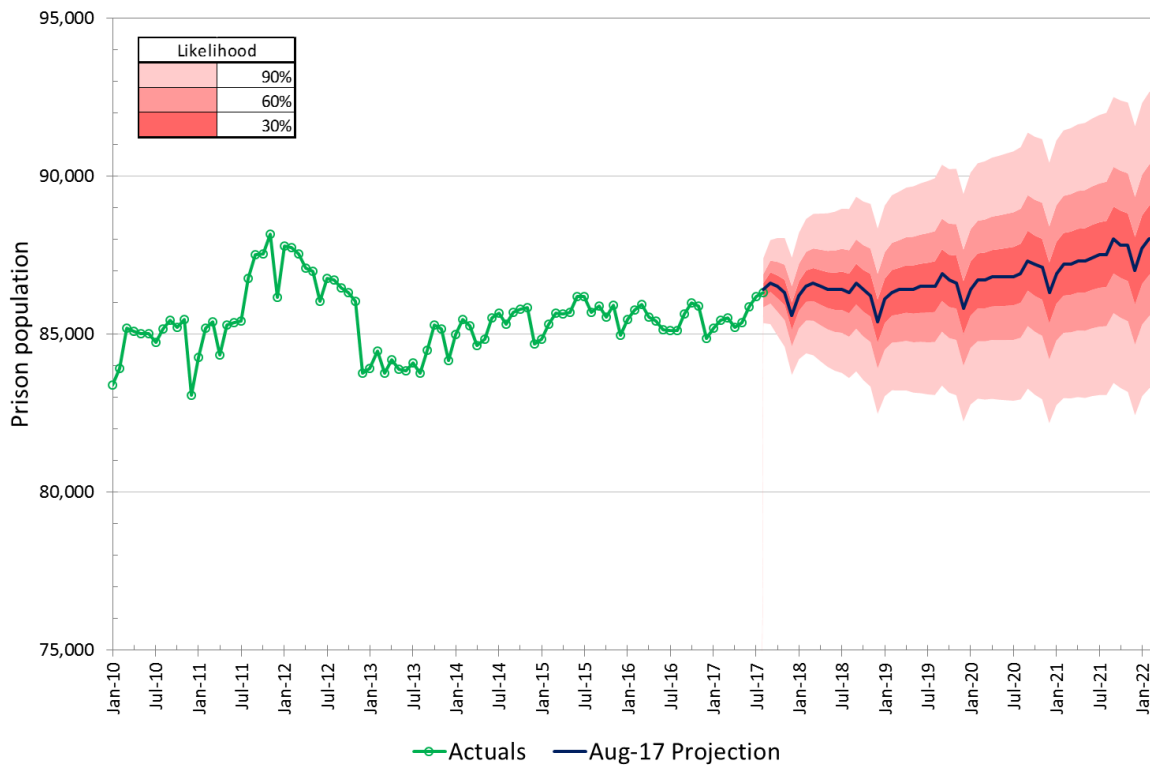


Table 2.1: Estimated likelihood of prison population reaching or exceeding levels, June 2018 to June 2021¹²

	95%	80%	65%	50%*	35%	20%	5%
June 2018	83,800	85,100	85,800	86,400	86,900	87,600	88,900
June 2019	83,100	84,800	85,700	86,500	87,200	88,200	89,800
June 2020	82,900	84,800	85,900	86,800	87,700	88,800	90,700
June 2021	83,000	85,200	86,400	87,400	88,500	89,700	91,800

*50% likelihood represents the 2017 projection

**Intervals may not be symmetrical due to rounding of figures to nearest 100

¹² Likelihood ranges in Figure 2.1 are here split into their symmetrical lower and upper bounds and the likelihood of actual population reaching or exceeding those levels. For example, the 60% likelihood range in Figure 2.1 contains all values greater than or equal to the 80% level and less the 20% level (i.e. for a net 60% likelihood of falling between those levels).

3. Comparison against 2016 total population projection

As of June 2017 the prison population was 1,300 places above the previous 2016 projection. The 2017 projection is 2,700 places higher than the 2016 projection in June 2018 and 2,900 places higher in March 2021.

Declines in sentenced volumes expected in the August 2016 projection were offset by increases in average custody rate and custodial sentence lengths in 2016. There has been growth in the remand population above levels expected in the 2016 projection.

A comparison of the August 2016 total population projection against actuals to date and the latest August 2017 projection is presented in Figure 2.

Figure 3.1: Comparison of August 2016 total population projection against actuals and latest August 2017 projection (Source: Table A5 and Table A6)



At the end of June 2017 the total prison population was tracking 1,300 places above the August 2016 projection, a deviation of 1.5%. A deviation from projection of this size in either direction would have been expected 40% of the time.

The 2017 projection is 2,700 places higher than the 2016 projection in June 2018 and 2,900 places higher in March 2021 (the end of the 2016 projection horizon).

The 2017 projection reflects more recent data available on prison population, prison reception and discharges as well as shifts in the sub-offence mix of cases within the criminal justice system, and associated implications for sentencing outcomes.

Expected declines in Crown Court trial case disposals were observed in 2016, however these were partially offset by increases in the number of triable either way cases either sentenced in the magistrate's court or committed for sentencing in the Crown Court.

More significantly, there were increases in custody rate and length of custodial sentences received for those offenders sentenced in 2016 compared to 2015 – specifically for triable-either-way and indictable offences. There were shifts in the mix of offences – particularly in the mix of drug offences where reductions in offenders sentenced for class B was offset by increase in offenders sentenced to class A-type offences. This had the result that custody rates and sentence lengths for drug offences disposed of increased significantly in 2016.

4. Projection of over 50, 60 and over 70 year old populations

The populations of over 50, 60 and 70 year olds in prison are all projected to increase, both in absolute terms and as a proportion of the total prison population.

These increases are predominantly driven by prior shifts in the offence mix of prisoners flowing into prison – specifically increases in sexual offending.

Table 4.1 shows projections of prison population aged over 50, 60 and over 70 years old and their proportion relative to total population. All of these age-specific sub-populations are projected to rise both in absolute terms and as increasing proportions of the total population.

Table 4.1: Prison population and proportion of total population aged over 50, 60 and 70 years old, June 2017 actuals and projected June 2018 to June 2021

	Total	50 to 59	60 to 69	70 and over
June 2017	85,863	8,564	3,213	1,599
June 2018	86,400	8,700	3,400	1,700
June 2019	86,500	8,700	3,600	1,800
June 2020	86,800	8,900	3,700	1,900
June 2021	87,400	8,900	3,800	2,100

*Figures may not sum due to rounding of projected figures to nearest 100

The over 50 year old population is projected to grow from 13,376 as at 30 June 2017, to 14,800 in June 2021. The over 60 year old population is projected to grow from 4,812 to 5,900 over the same period. The over 70 year old population is projected to grow from 1,599 to 2,100. The population aged over 50, 60 and 70 years are all projected to grow as a proportion of the total prison population.

Growth is projected as volumes of offenders aged 50 and over being sentenced to custody is currently higher than the number being released – driven by increases in sexual offence proceedings since 2012. This effect is compounded in the interim by the longer sentences offenders are receiving, resulting in an increase in the number turning 50, 60 or 70 whilst in custody. Further growth relates to projected growth in recalls and an ageing lifer population.

5. Links to related Ministry of Justice statistics

For further information on:

- The latest statistics on court receipts visit:
www.gov.uk/government/collections/criminal-court-statistics
- The latest statistics on the criminal justice system, including information on sentencing, visit:
www.gov.uk/government/collections/criminal-justice-statistics-quarterly
- The latest statistics and commentary on the prison population visit:
www.gov.uk/government/collections/offender-management-statistics-quarterly
- The Story of the Prison Population 1993-2016 visit:
www.gov.uk/government/statistics/story-of-the-prison-population-1993-to-2016
- Weekly prison population and capacity figures visit:
www.gov.uk/government/collections/prison-population-statistics

TG1. Modelling methodology

The prison projections model is part of wider work within the Ministry of Justice to develop a consistent and coherent suite of models of the criminal courts and offender management, driven by common projections of demand for the Ministry of Justice's services. Two key components of this suite are used to develop these projections, a custodial convictions model and a prison population projection model.

The custodial convictions model is driven by projections of numbers of defendants entering the criminal courts. In order to project volumes of defendants being given a custodial sentence, it also takes into account:

- the age band, sex, and offence of defendants entering the system;
- resources required to process cases through the courts; and
- the sentences which concluded cases attract.

The prison population projections model takes projections of custodial convictions, converts them to projections of prison receptions and then models the amount of time that offenders spend in prison to calculate the resulting prison population. The model also simulates the ageing of the prison population over time. The benefits of this method are that it allows us to:

- explicitly project custodial convictions (rather than just convictions);
- understand the criminal justice system factors which contribute to change in the prison population, such as time served, sentences given, changes to court processes or shifts in defendant demographics; and
- more easily model the impact on the prison population of specific Ministry of Justice and other criminal justice agency policy changes relating to specific offences or specific sentences.

The assumptions informing these projections, and therefore the projections themselves, are subject to uncertainty. The level of uncertainty of the projections is estimated and presented in Chart 2.1 and Table 2.1 above and in Table A.9 of the accompanying statistical tables. The methodology applied to estimate projection uncertainty is outlined in appendix C.

The projection model is based on latest available data from various sources including court proceedings and performance data, and sentencing data. Latest P-NOMIS extracts, referenced in OM statistics, are utilised to model prison receptions and population data

The method used for generating projections of the prison population in England and Wales for the 2017-2022 projections is consistent with the approach used to generate the 2016-2021 projections published on 25 August 2016.

Appendix B provides further details of the methods used to produce the prison population projections and the assumptions behind them.

TG2. Caveats on prison population projections

The projections presented reflect the impact of trends in sentencing, in the age band, sex, and offence of defendants entering the system and in the flow of defendants through the courts. The impacts of publically announced changes to legislation and guidance which took place before August 2017 and views of future parole hearing frequency and outcomes for indeterminate sentence prisoners have also been taken into account.

The projections do not reflect the impact of legislative, policy, operational or procedural change or guidance for which there is no definite timetable for implementation. The projections therefore provide a “baseline” against which the impacts of future changes can be assessed.

Even without these possible changes, the actual future prison population may not match the projection. Changes to criminal justice processes could influence the numbers of offenders being brought to the point of sentence or the way that offenders are managed. Changes to sentencing behaviour may also be different from those modelled. Finally, both sentencing behaviour and criminal justice processes, as well as policy decisions, can respond to a multitude of environmental factors which cannot be anticipated, such as high profile criminal cases, events like the August 2011 public disorder events, and public debate.

Assumptions for modelling were agreed through consultation with policy and operational experts at the Ministry of Justice, Her Majesty’s Prison and Probation Service, The National Police Chiefs Council, Home Office and Crown Prosecution Service. The assumptions are based on analysis (where reliable data are available) and on expert judgement from policy makers, key deliverers and system influencers. The assumptions are therefore likely to be more robust for those measures and processes that have a well-defined boundary than for those that do not.

TG3. Detail of models and assumptions

The modelling approach

The prison projections form part of the Ministry of Justice's wider work to develop a consistent and coherent suite of models of the criminal courts and offender management, driven by common projections of demand for the Ministry of Justice's services.

The prisons model used to generate this projection has not changed substantially from that used in the last projections. As in the 2016 projections, custodial sentence lengths used in the model are disaggregated by sex and age band of the offender, and the offence type. The total time to be served in prison by projected future prisoners is assigned by matching their sex, age band, and offence characteristics to relevant distributions of (i) custodial sentence lengths and (ii) the percentage of custodial sentence served. These distributions are derived from latest available data. This allows us to:

- understand the criminal justice system factors which contribute to change in the prison population, including sentence lengths issued, the percentage of sentence served in custody, trial court and sentencing court changes, or shifts in the demographic characteristics of defendants;
- model the impact on the prison population of specific Ministry of Justice and other criminal justice agency policy changes; and
- quantify the impact of uncertainty around the time a defendant serves in prison on the prison population.

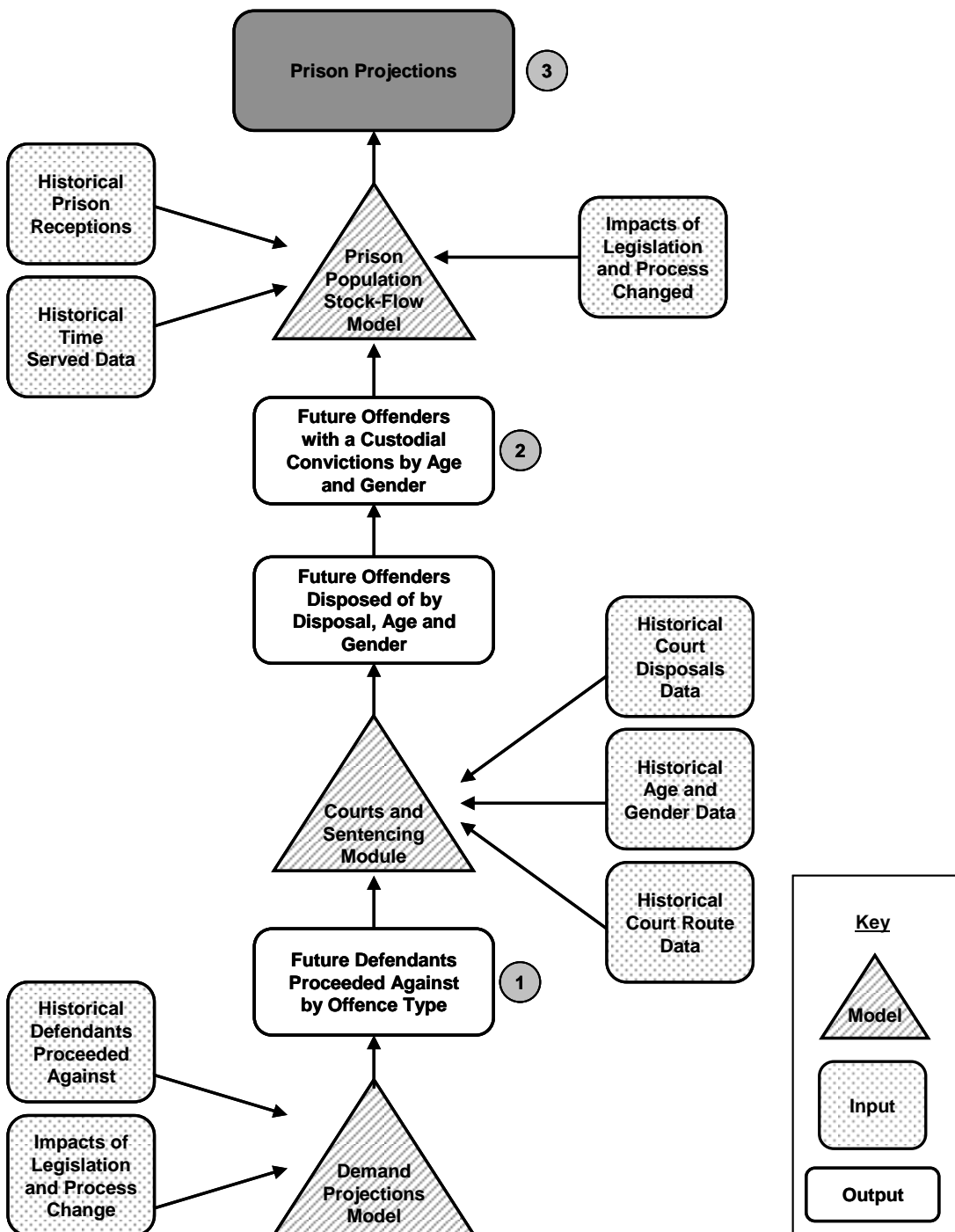
Overview of the modelling approach

Central to the modelling approach is the Prison Population Stock-Flow model. Projections of future custodial convictions are fed into this model and outputs are adjusted to account for the impact of changes in legislation and process on the prison population, as shown in Figure B1, and described below.

1) Producing projections of defendants proceeded against

Projections of defendants proceeded against at court are chosen as the entry point to the modelling system because this is the entry point of defendants into the Ministry of Justice's area of responsibility. Underlying crime levels and the activities of the police and CPS will have an impact on the volume of defendants proceeded against.

Figure B1: Key Components of the prisons projections modelling system



The Demand Projections Model produces baseline projections of all defendants proceeded against at court for high-level offence categories. This is based on historical time series data at a monthly resolution sub-divided by region and age for the Magistrates' court and region for the Crown Court.

The demand projections are based on time series decomposition methods that explicitly take into account level, trend and seasonal components of court receipts data.

It should be noted that these projections cannot be expected to track actual volumes of defendants proceeded against if there is any sudden or cumulative change which takes demand volumes or offence mix well outside the trends seen historically.

2) Converting the demand projections into custodial convictions

A Courts and Sentencing Module converts the demand projections into a set of projections of disposals by disposal type (including custodial convictions), offence, sex and age band at a monthly resolution. These projections of custodial convictions by sex, age band and offence type are used as a key input for the Prison Population Stock-Flow model.

The Courts and Sentencing Module is a combination of the Magistrates' and Crown Court Workload Models and the Sentencing Module. The demand projections are used as an input into a Magistrates' Workload Model, which uses historical data to split defendants into court routes (Table B1) and tracks their flow through the system.

The Crown Court workload model takes forecasts of caseload and assigns various attributes (e.g. early guilty plea, effective trial mix) to estimate likely hearing times and the resulting flow of cases through the system. The cases disposed of are then converted to the number of defendants disposed of using recent data for the observed ratio between cases and defendants.

The key assumptions that are used in the Courts and Sentencing Module are:

- that there is no prioritisation of any age or sex group within the Magistrates' and Crown Court;
- the number of working days in each month is the primary driver of seasonality within the Magistrates' and Crown Court;
- no change in offence type occurs as cases move through the system;
- defendants that are tried at the Magistrates' Court proceed to sentencing without delay;
- delays within the Magistrates' Court are not significant for the monthly timescales used in the modelling; and
- a Magistrates' Court backlog will not develop during the forecast period.

The Sentencing Module takes the number of defendants disposed of in the Magistrates' Workload Model and the Crown Court Workload Model and applies sentencing splits based on analysis of court proceedings data. This results in a set of projections as broken down in Table C1. These are aggregated providing forecasts for each offence, sex, age band, and disposal category, which are used as the custodial conviction projections.

Table B1: Courts and Sentencing Module Splits Dimensions

Offence Group	Sex	Age Band	Court Route	Disposal Type
Violence against the person	Male	Age 10-17	MC	Discharge
Sexual offences	Female	Age 18-20	MC/CC	Fine
Robbery		Age 21+	CC	Community Sentence
Theft Offences				Suspended Sentence
Criminal damage and arson				Custodial < 6 months
Drug offences				Custodial 6 months < 1 year
Possession of weapons				Custodial 1 year < 4 years
Public order offences				Custodial + 4 years
Miscellaneous crimes against society				Indeterminate
Fraud Offences				Otherwise Dealt With
Summary non-motoring				
Summary motoring				

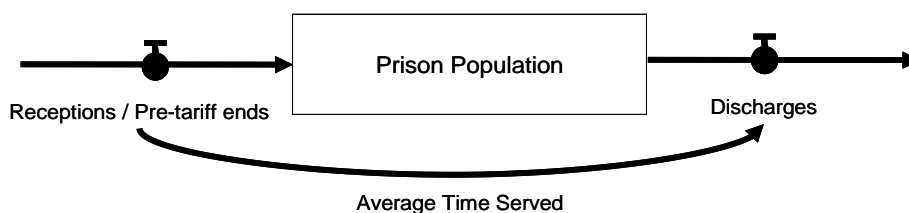
Key to the court route splits: MC: those tried and sentenced in the Magistrates Court; MC/CC: those tried in the Magistrates Court and Sentenced in the Crown Court; CC: combines those defendants who are committed for trial in the Crown Court and sent for trial in the Crown Court into a single category.

If required, the Courts and Sentencing Module allows trends in offender demographics and courts and sentencing processes to be incorporated into custodial convictions projections. This procedure was implemented to create the custodial convictions projections used in this projection.

3a) Producing prison population projections

Prison population projections are produced using the Prison Population Stock-Flow Model. The principal sub-populations in prison – determinate sentence, life sentence, imprisonment for public protection (IPP) and remand – are modelled using stock-flow structures based on the generic structure shown in Figure C2. The stock-flow structures model the flow of offenders into and out of prison and count the resulting prison population at the end of each month.

Figure C2: Generic stock-flow structure in the Prison Population Stock-Flow Model



For the determinate population, the monthly inflows to prison are based on the custodial convictions projections described above. These custodial convictions include offenders that may already be serving a sentence for a previous crime or those who would serve their whole custodial sentence on remand, meaning that they would not be a new reception to prison. To convert from custodial convictions to prison receptions a conversion ratio derived from the historical proportions of custodial convictions is applied to prison receptions for each sub-population averaged over 2016 data.

Monthly outflows for the determinate population are based on observed custodial sentence lengths and the observed percentage of sentence length served. Each projected offender that enters the model is given a custodial sentence length that is

randomly selected from the relevant distribution. These distributions are populated with custodial sentence lengths from actual offender receptions who share the same characteristics of offence, sex, and age band in the observed time period. The percent of custodial sentence length served is derived in the same manner, except that the observed distribution is made up of discharged offenders further disaggregated by custodial sentence length band.

For offenders who receive the new EDS sentence an adjustment is made to the percent of custodial length served to reflect that these offenders will spend a greater proportion of their sentence in custody than standard determinate sentenced offenders discharged to date.

Projected prison receptions are sub-divided by age band (Juvenile, Young Adult, Adult) with the exact age of the offender attributed in the same manner as the custodial sentence lengths. This allows the model to explicitly age the offenders whilst in prison (e.g. move from Juvenile to Young Adult categories).

The approach for the other sub-populations is similar and has not been substantially revised since the 2016 publication. The methodology applied to each is briefly outlined below.

The remand population is projected based on latest available time-series data around remand stocks and flows of offenders into and out of remand. The projection takes account of changes in operational performance and policies that are expected to have impacts on time served on remand via the Courts and Sentencing Module.

IPP and life sentence prisoners have an extra section in the stock-flow structure which models the indeterminate nature of their sentence lengths. Outflows for IPP and life sentence prisoners depend on the tariff lengths they receive and on the frequency and outcome of Parole Board hearings. The values of these parameters are set and calibrated to reflect the most recent management information on Parole Board outcomes.

The recall population is projected based on latest available time-series data on the stock of offenders on recall. Indeterminate recalls are treated explicitly based on data and assumptions around future release and recall rates, and conditional on Parole Board capacity as per the indeterminate population.

The population in prison at the end of each modelled month is aggregated into the categories defined by sex, current age band and, for determinate sentence prisoners, sentence length band, to produce raw, unadjusted prison population projections.

3b) Accounting for the impacts of circumstance, legislation, and for seasonal effects

The raw, unadjusted prison population projections are subject to model adjustments to show the impact of certain provisions in the 2014 ROTL review, the Criminal Justice and Courts Act 2015, the Serious Crime Act 2015 and the EU Prisoner Transfer Framework Decision. Model adjustments are also used to account for seasonal variation in the population.

Custodial conviction projections for each sub-population were smoothed using a centred 12 month average. No seasonality in prison receptions and discharges was modelled

explicitly. Seasonality was measured in the historical prison population and applied as a series of percentage adjustments to the final population projections. Seasonal factors for the determinate population were identified for each month by measuring statistically significant deviations from a centred 12 month average.

TG4. Method for calculating projection uncertainty

As with any projection, there is uncertainty in the projection of the prison population, arising from several sources. This includes uncertainty in model parameters as well as future changes in behaviour or policy that are uncertain or unexpected at the time of projection.

This publication includes a fan chart, a commonly-used method of communicating uncertainty in a time series projection. The performance of previous published projections against the actual population has been analysed and used to estimate the uncertainty in the prison population.

Projections of the total prison population have been published annually since 2008. Several years' worth of projections are therefore available to compare projected population levels against actuals. The fan chart should be considered an estimate of the expected levels of uncertainty, informed by past performance, rather than a precise set of limits on the population.

Fan chart and interpretation

Chart 3 shows the prison population projection as a solid line. This can be interpreted as the single most likely population, given the agreed set of assumptions. Around the projection are three bands, indicating the range of populations with estimated 30%, 60% and 90% likelihoods. The interpretation is that, assuming no significant differences between the conditions under which the previous projections were made and the conditions under which the current projection has been made, there is a 30% likelihood that the population will stay within the inner band, a 60% likelihood that the population will stay within the second band and a 90% likelihood that the population will stay within the outer band.

Technical details

The fan chart is calculated by fitting a distribution to the percentage errors between prior projections and observed actual population figures. Distributions of errors are calculated at each time interval from date of start of projection. A normal distribution is fitted at each interval, characterised by a mean and a standard deviation. For this fan chart, the mean is assumed to be the prison population projection. As more published projections become available in future, it may be possible to further refine the characterisation of uncertainty (for example assessing whether a skewed two-piece normal distribution is more appropriate).

The standard deviation at each time point is calculated in the following way:

1. Calculate the percentage difference between the projected and actual populations for each time interval (i.e. difference one month after forecast, two months after forecast etc.) after the forecast date;
2. Calculate the standard deviation of the percentage differences for each time interval from date of projection;
3. Fit a power law to this series of standard deviations as a function of time interval (i.e. a function of the form $y = ax^b$, where y is the standard deviation and x is the time after projection);

4. Use this function to infer estimates of the standard deviation of errors at each time interval up to the end of the projection period.

This method is in line with the method used in the previous 2016 publication.

Further information

National Statistics status

National Statistics status means that official statistics meet the highest standards of trustworthiness, quality and public value.

All official statistics should comply with all aspects of the Code of Practice for Official Statistics. They are awarded National Statistics status following an assessment by the Authority's regulatory arm. The Authority considers whether the statistics meet the highest standards of Code compliance, including the value they add to public decisions and debate.

It is the Ministry of Justice's responsibility to maintain compliance with the standards expected for National Statistics. If we become concerned about whether these statistics are still meeting the appropriate standards, we will discuss any concerns with the Authority promptly. National Statistics status can be removed at any point when the highest standards are not maintained, and reinstated when standards are restored.

Contact

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