Public Health England

Protecting and improving the nation's health

Predicting the size and characteristics of the drug treatment population – technical methods

Annex to evidence review of drug misuse treatment outcomes in England

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Contents

Aim and data specification

This analysis was based on monthly data from the National Drug Treatment Monitoring System (NDTMS) from December 2005 to November 2016. NDTMS is taken to be a comprehensive description of drug treatment provision for this period.

Looking forward for four years based on patterns observed in the preceding decade, the aim of this analysis is to estimate the size and characteristics of opiate and non-opiate treatment populations (adults only for the non-opiate population) to the end of 2020, with four specifications:

- the projected number in treatment (main models, herein)
- breakdown by age
- breakdown by duration of use (using career, herein, and opiate population only)
- breakdown by previous treatment (opiate population only)

With anticipated uncertainty in each projection (which could be increased with cross-referencing), the statistical models were computed independently. There is logical covariation between components (for example, between age and using career) but this has not been applied directly in the projections.

For the main treatment population models, a decision was taken to truncate the retrospective data to January 2011 (see ‘Reasons for truncation of the time period’ for rationale). Additional modelling was required for the non-opiate models to take into account the additional criteria to limit to adults only, as described below.

All analysis was done in SPSS (version 21) using latest available data.

Methodology

Main models

Month-to-month change in the size of the opiate and non-opiate treatment populations was estimated by predicting the number entering and exiting treatment in each month. Projections were carried out up to December 2020, based on data up to August 2016, with the assumption that the three most recent months were still incomplete. This was achieved through the following steps:

- use past trends to project the number of 'treatment naïve' presentations each month. 'Treatment naïve' is defined as the individual presenting to treatment having not previously been in treatment in the period of observation
- use past trends to project the number of treatment exits each month (taking into account trends in different exit reasons)
- based on treatment exits occurring in previous months, project the number re-presenting to treatment in each month (that is, individuals presenting to treatment having previously been known to treatment in the period, and taking into account that likelihood of re-presentation varies with different exit reasons)
- using the number of people in treatment at the start of a given month and projected presentations and exits in each month, estimate the number in treatment at the start of the next month
- for the non-opiate model only, project the number turning 18 years of age during treatment in each month, since people could enter the cohort by turning 18 as well as by presenting to treatment. Note: this was low and relatively stable across the period (averaging around 125 a month) and is not shown in the results

These projections were fitted then tested by running identical models with a cut-off point two years before the end of the period (i.e. August 2014) and then comparing the projected figures produced by the models to the actual data in the intervening two years.

Breakdowns by demographic and other factors

Projection estimates for age, using career and previous attempts at treatment were fitted to the full time series. Projections were made based on the proportion of the total population in each relevant category, eg each given age group, at the end of each month.

Projections by age were carried out by dividing the treatment population into five-year bands according to year of birth ('birth cohorts', herein). As the treatment population over this short period was clustered by year of birth, truncation is required when projections

would begin to become very unstable. For example, the analysis for opiates was limited to five-year bands starting at 1946 and ending at 1990, which included 99.7% of the population at the end of 2015. Projections of the post-1990 birth cohort were fitted with a deliberately liberal model in acknowledgement that there will be younger users who have not presented for treatment.

The pre-1946 birth cohort was assumed to be the remainder based on other projections. The estimates for each birth cohort were then translated to age groups at the end of 2005, 2010, 2015 and 2020, since it is only at these points that we can be certain that those in a given birth cohort will all be in one age group (in other words, at the end of 2005 we know everyone in the 1981-1985 cohort will be aged 20-24).

Age groups were pooled to allow fair comparison over time (for example, for opiates, age groups were set to under 30 years; five-years bands between 30 and 59 years, and 60 or older). In the non-opiate model, the youngest birth cohorts were not considered in the projections until at least some of the cohort could be aged 18.

Projections by opiate use career were done using the same method used for projections by age, instead referring to the five-year period that the person reported starting to use (‘uptake cohorts’, herein). Using the age of first use variable in NDTMS, it was assumed in the absence of a more exact indication that this initiation was halfway through the reported year (that is, date of birth, plus age of first use, plus six months). As with the projections by age, there was truncation at each end when numbers became too low to stably predict, with five-year bands for opiate users between 1981 and 2010.

Projections for the post-2010 uptake cohort were modelled from the beginning of 2011. Again, a liberal model was used in acknowledgement that there will be newer users not yet known to treatment. The pre-1981 uptake cohort was assumed to be the remainder based on the other projections. Estimates were calculated for the end of 2005, 2010, 2015 and 2020 as it is only at these points we can be certain those in a given uptake cohort will all be in one group by using career. Groups by using career were derived from the uptake cohorts and pooled as necessary.

As it is only possible for patients to gain previous attempts at treatment by re-presenting to treatment (that is, they could never descend through the categories), projections by previous attempts at treatment were calculated according to the likelihood of the person being counted in a given category *or higher*. Therefore, projections were fitted to the numbers with 4 or more previous attempts, 3 or more previous attempts, and so on. These were then disaggregated to give the final projections for each category distinctly.

Figures for the end of 2005, 2010 and 2015 for these models use actual totals from NDTMS. Figures for the end of 2020 are described as projected based on activity from December 2005 onwards, and should be regarded as being subject to much greater uncertainty as a result.

Underlying assumptions and caveats

The models are based on the following assumptions:

- *that there are no unforeseeable changes in external influences leading to significant reduction of increase in treatment demand.* An example of this would change in purity and availability of heroin in the illicit market, which could lead to variations in treatment uptake as well as having other effects that would impact upon on the treatment population (eg, heightened overdose risk)
- *incidence and prevalence continue to follow existing (declining) trends.* Prevalence estimates of the number of opiate users have been declining in recent years, at least up to the most recent estimates in 2011/12.[1] A recent analysis of incidence (new uptake) of opiate use tentatively suggested that incidence may be increasing after several years of decline,[2] although there was a broad range of uncertainty. If new using cohorts were to emerge, this could in turn lead to greater treatment uptake and could also impact on distributions of the treatment population by age, using career and previous attempts at treatment
- *treatment system capacity is not a factor.* In effect, the models assume numbers can go up and down without restraint. This would be particularly significant if increased numbers in treatment were projected, as it would also have to be assumed that the system would be able to meet the demand
- *re-presentations to treatment are driven only by preceding treatment exits and rates and speed of re-presentation are reasonably stable across the period.* The model for projecting re-presentations to treatment assumes that each person exiting at any given point has the average likelihood of re-presenting to treatment for the given exit reason, and will re-present at a speed in keeping with the general distribution of time to re-present. This would start to prove problematic if the re-presentation rate or speed of re-presentations were to change during the period, either due to changes in practice or external influences
- *seasonal variation will even out.* As the model uses monthly treatment numbers these will inevitably be subject to seasonal differences. This variation is assumed to even out over the course of a year but is not taken into account in the projections. Therefore, the projections reflect the expected general direction of travel rather than seeking to identify exactly what changes might be anticipated in any given month. For example, it is known that there are reduced numbers of people entering and exiting treatment in December but the projected figures for each December do not take this into account

Projections for the opiate treatment population

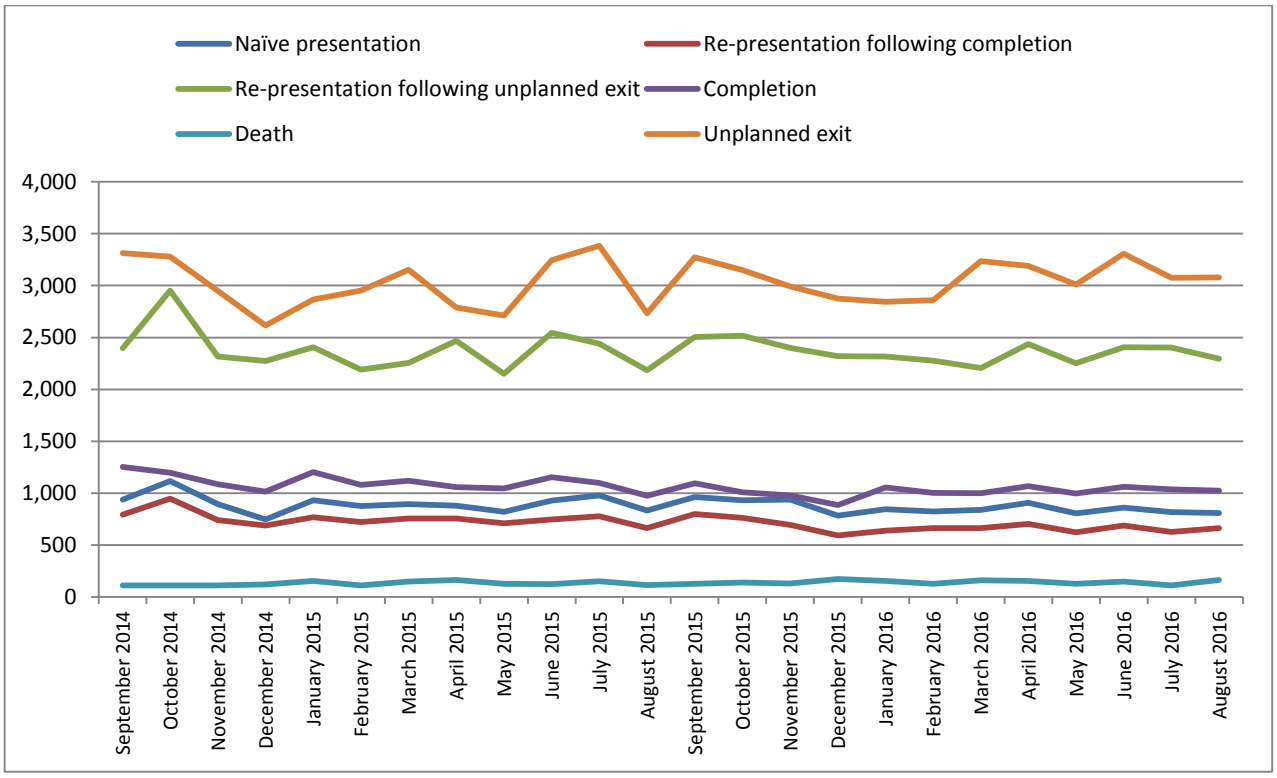
Main models

The models for opiates were constructed for the period January 2011 to August 2016, for the reasons set out in the 'Reasons for truncation of the time period for main models' section below.

The final models were tested by re-running all the models for the period January to August 2014, projecting through September 2014 to August 2016 and comparing this to the actual figures over this time.

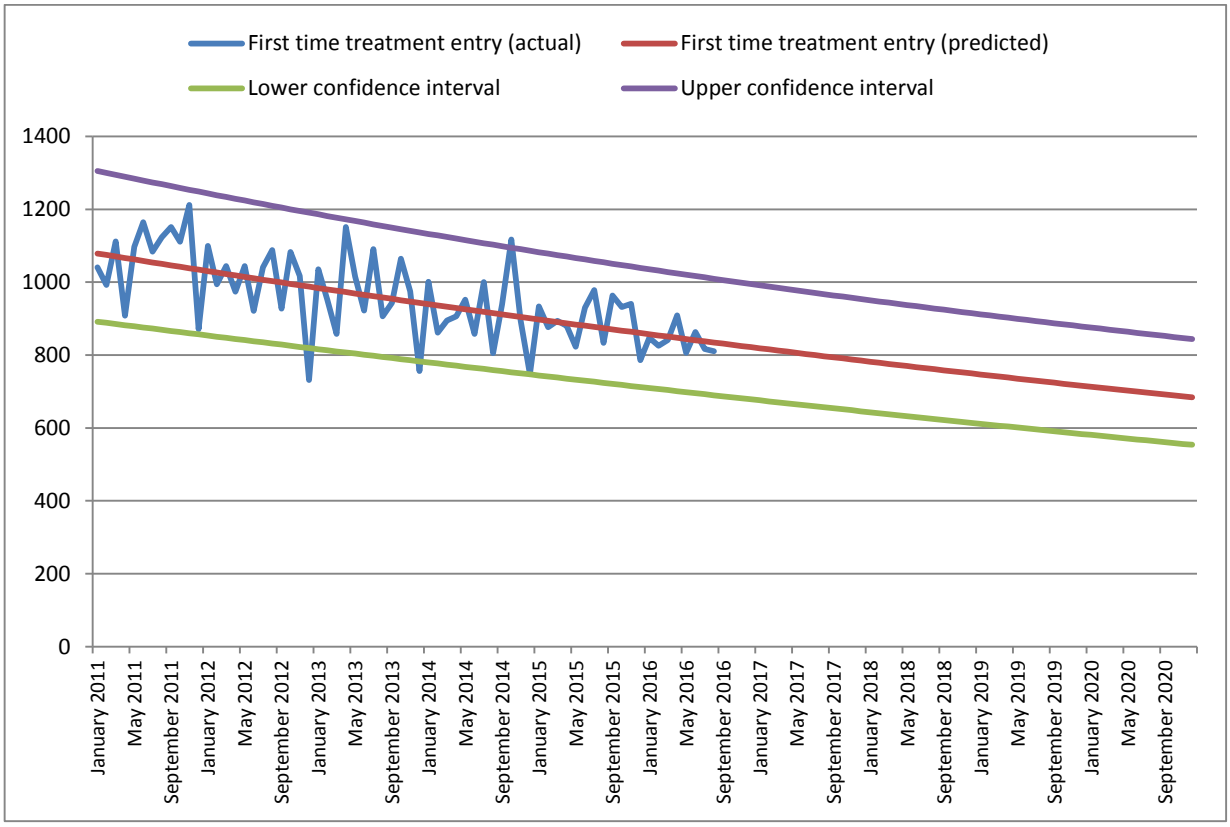
The monthly distribution of entry and exits to the treatment system between September 2014 and August 2016 is shown in Figure 1. It can be seen that, throughout the period, the majority of exits were due to unplanned exit (72% of all exits in the period) and the majority of presentations were re-presentations preceded by an unplanned exit (60% of all presentations). Completions fell across the period, while the number of re-presentations that followed a completion remained broadly stable . As these can be re-presentations any distance after a treatment completion, this does not necessarily imply a rising re-presentation rate over time.

Figure 1. Opiate monthly treatment entry and exits (September 2014 to August 2016)



Viewed more closely, naïve presentations are falling slightly (Figure 2 below). The model fitted suggests that if this decline continues as it has between 2011 and 2016, there would be around 684 naïve opiate presentations a month by December 2020 (95% confidence interval [CI]: 554 to 844), down from an average of 862 a month in the 12 months up to August 2016.

Figure 2. Actual and projected treatment naïve opiate presentations (January 2011 to December 2020)



The number of completions, unplanned exits and deaths shown in Figure 1 were converted to rates in each month, to take into account changes in the size of the overall population and provide a steadier estimate. It should be noted that these monthly rates will be much lower than equivalent annual rates as a person is much more likely to be retained in treatment from month to month than from year to year.

Figure 3 (overleaf) shows the completion rate at each month, as a proportion of the total number in treatment in that month. This suggests a projected fall to 0.6% completing in a month by December 2020 (95% CI: 0.5% to 0.7%), from an average of 0.9% in the 12 months up to August 2016.

Figure 3. Actual and projected opiate completion rates (January 2011 to December 2020)

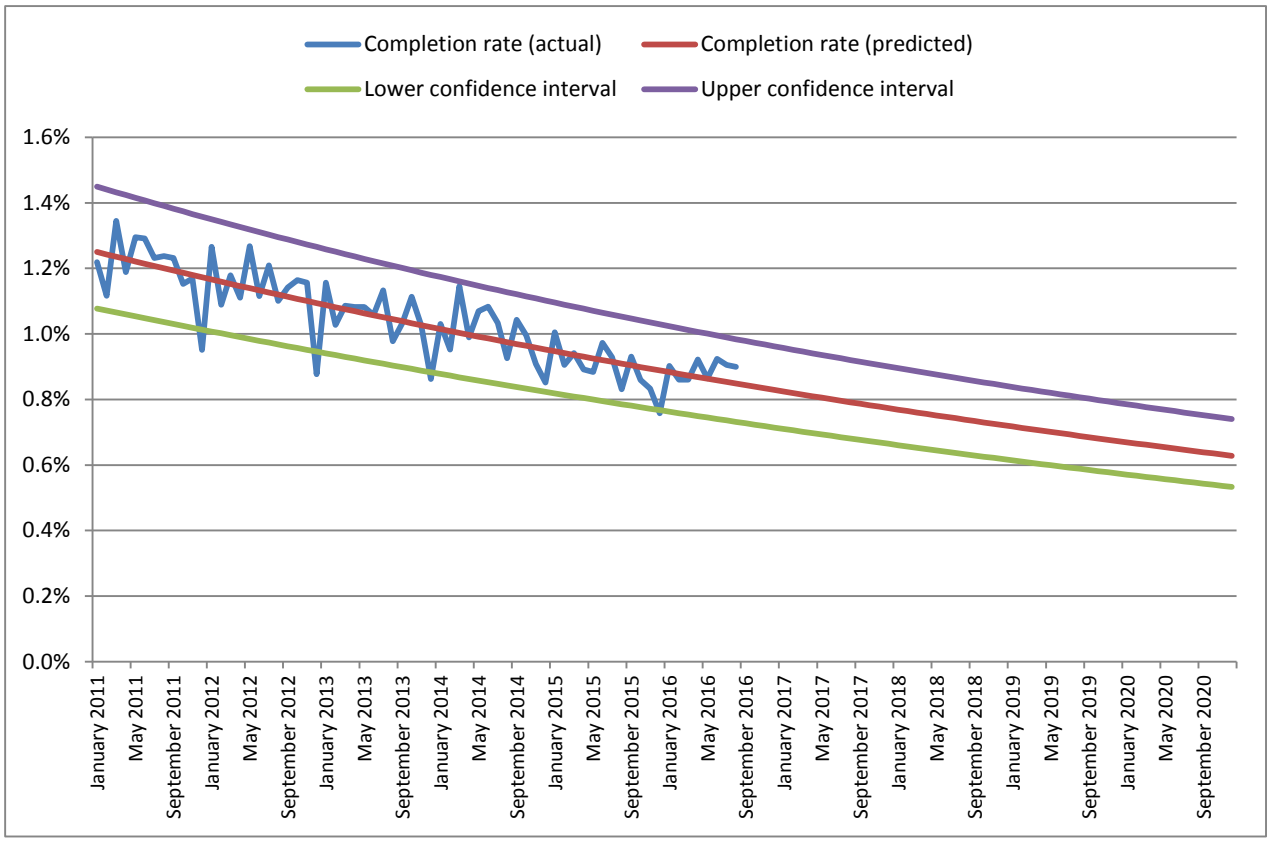


Figure 4 (overleaf) shows the rate of unplanned exits at each month, as a proportion of the total number in treatment in that month. This suggests a projected rise to around 3.1% exiting in an unplanned way each month by December 2020 (95% CI: 2.6% to 3.7%), from an average of 2.6% in the 12 months up to August 2016. The unplanned exit rate has only increased slightly from an average of 2.2% in 2011, so the prediction suggests a broadly consistent increasing trend through to 2020, but this is subject to considerable uncertainty as shown in the confidence intervals.

Figure 4. Actual and projected opiate rates of unplanned exits from opiate treatment (January 2011 to December 2020)

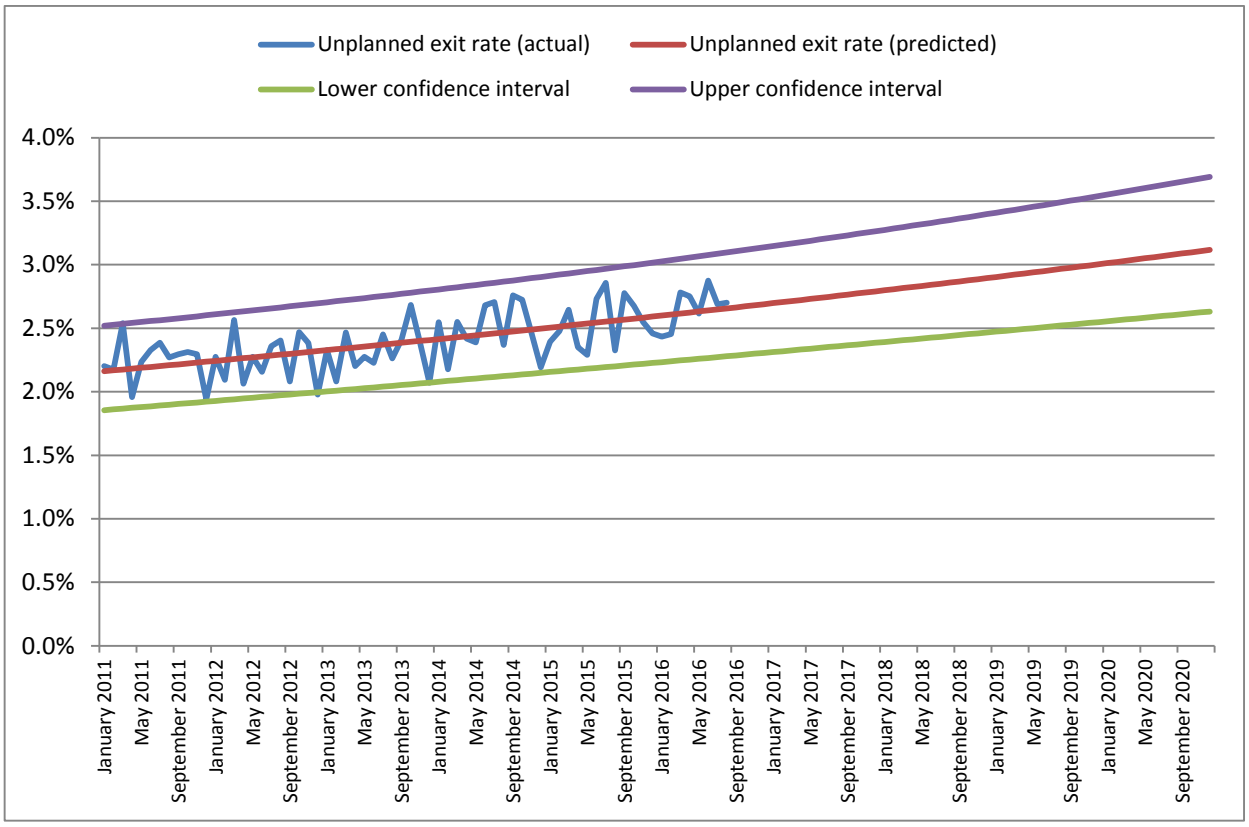


Figure 5 (overleaf) shows the mortality rate in treatment at each month, as a proportion of the total number in treatment in that month. This suggests a projected rise to 0.3% of those in treatment dying each month by December 2020 (95% CI: 0.2% to 0.3%) from an average of 0.1% in the 12 months to August 2016. It should be noted that this represents a relatively pessimistic projection of deaths in treatment from the available models. However, other available models underestimated the number of deaths and there is a notable upturn towards the end of this period. Furthermore, a rising trend would be consistent with other indicators of an aging population.

Figure 5. Actual and projected mortality rates in opiate treatment (January 2011 to December 2020)

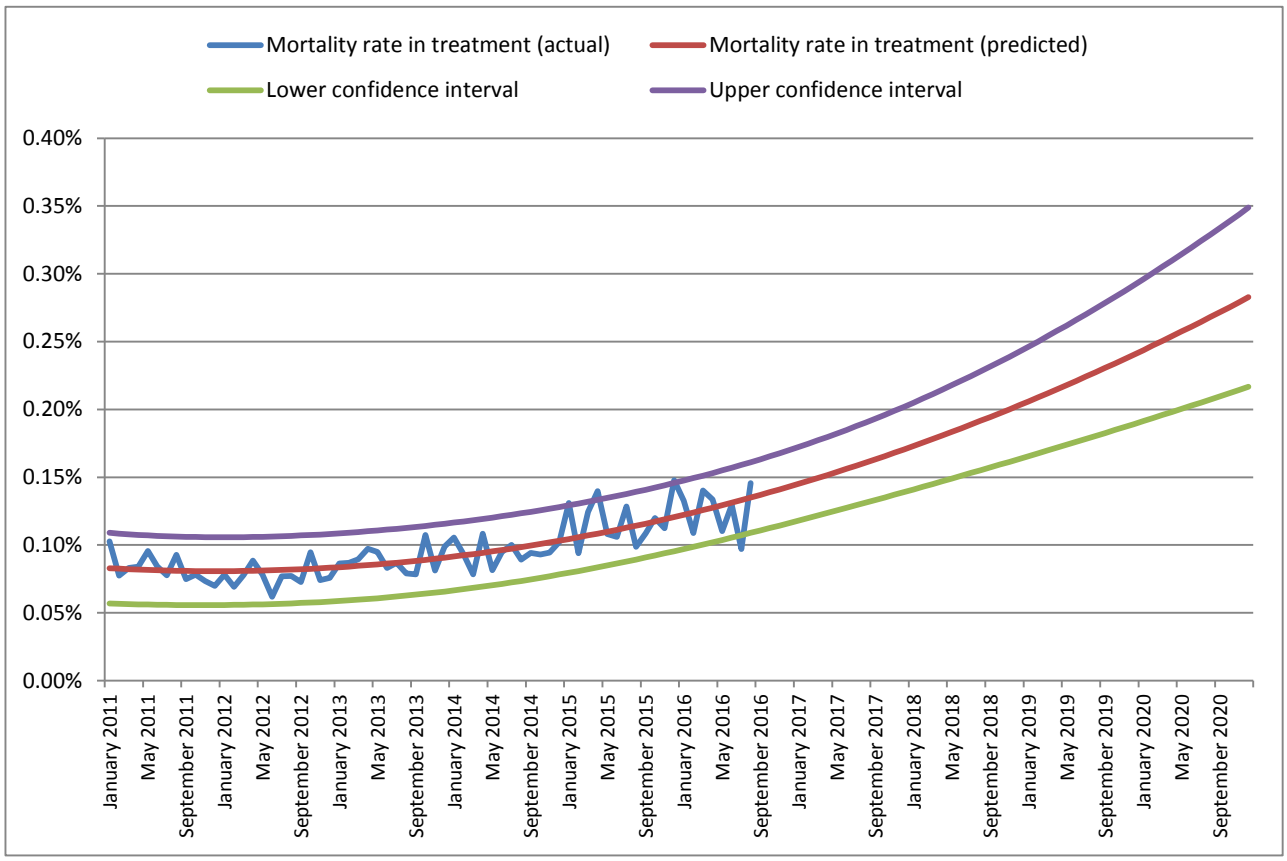
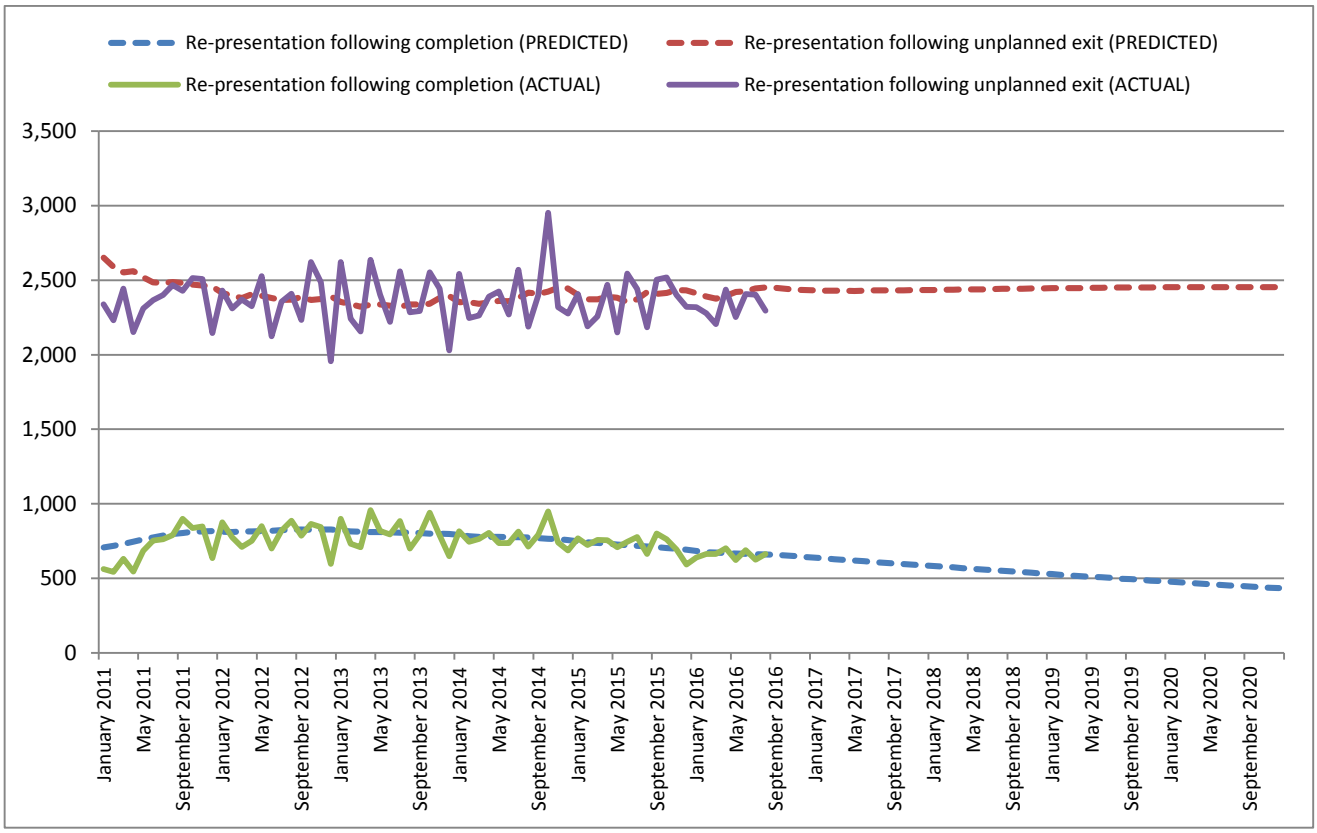


Figure 6 (overleaf) shows the actual and projected numbers of re-presentations following completion or an unplanned exit from January 2011 to December 2020. Projected figures are based on the re-presentation rates observed across the period and assume that individuals re-present within a typical distribution of time to re-presentation. It can be seen that these broadly correspond to actual numbers in recent years and project increased re-presentations following unplanned exits and reduced re-presentations following completions. It should be noted that in the latter part of the period these projections are increasingly based on the projected completion and unplanned exit rates, and hence it can be seen that projected re-presentations following treatment completions logically result from the projected fall in completion rates. The total number of re-presentations each month is projected to fall slightly by 2020, to just under 2,900 from an average of just over 3,000 a month on average in the 12 months up to August 2016.

Figure 6. Actual and projected number of re-presentations following completion or unplanned exit from opiate treatment (January 2011 to September 2020)



Testing of main models

The main opiate models were tested for the period September 2014 to August 2016. For this, we ran identical models on the period January 2011 to August 2014 and projected through to August 2016. On September 2014 there were 115,937 opiate users in treatment and on 1 September 2016 this had fallen to 109,558. Using the central estimates from each of the main opiate models led to a projected number in treatment on 1 September 2016 of 110,245, meaning that the models projected an overall fall slightly smaller than that which actually occurred.

It should be noted that opiate treatment journeys tend to be relatively long, with a large number of individuals retained in treatment from month to month, which limits the impact of any volatility in these models. The decline of 6,379 in the opiate treatment population over this time is accounted for by 95,307 new presentations to treatment and 101,686 treatment exits (ie, 6.7% more exits than presentations). The models predicted a fall of 5,692, based on 94,476 new presentations to treatment and 100,168 exits (6.0% more exits than presentations). This slight shortfall was largely due to the model under-predicting unplanned exit rates in the test period, as there was an acceleration in the increasing trend in unplanned exit rates in this period.

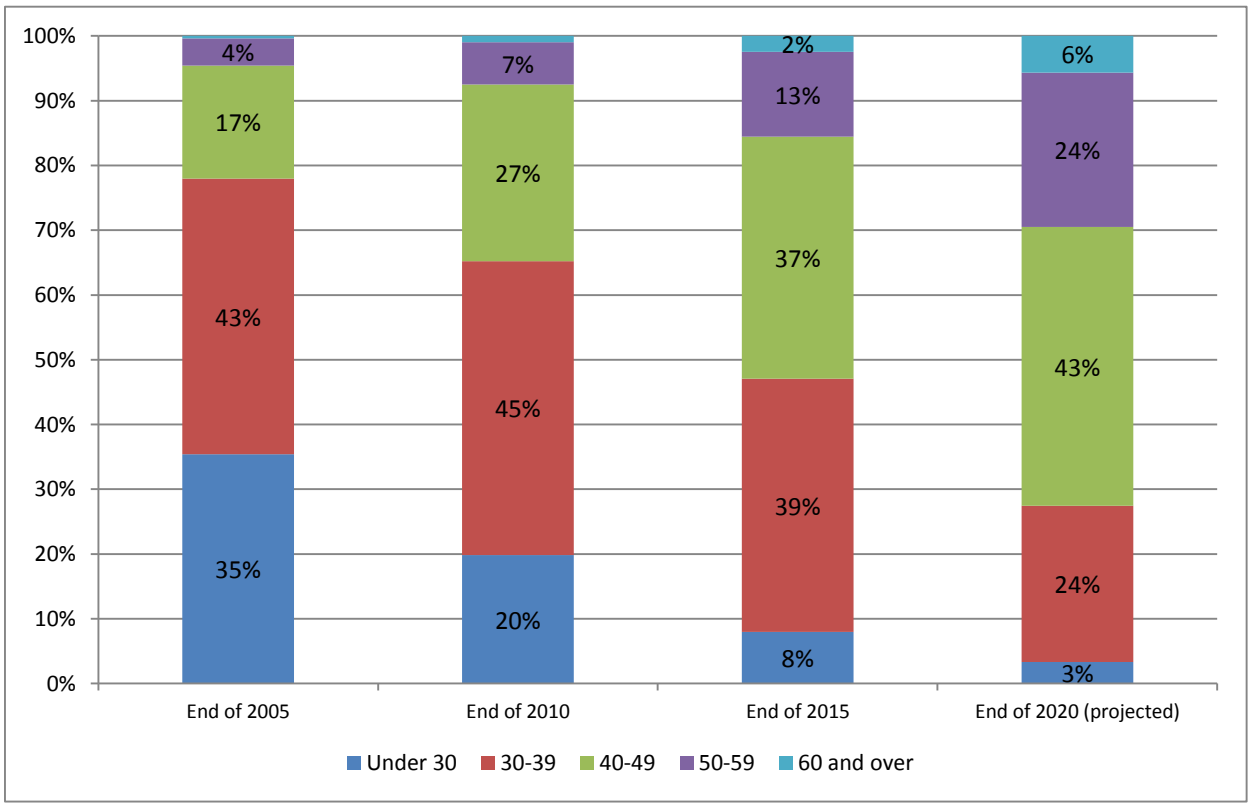
Summary of main models

In summary, the main models suggest that the factors which influence overall numbers in treatment – naïve presentations, treatment exits for different reasons and re-presentations following those exits – will each continue to increase or decrease in keeping with generally clear recent trends. Overall, these projections suggest a continuation of the trend in recent years that exits from treatment exceed new presentations to treatment, which would suggest a continuing marked decline in treatment numbers. Model components are subject to uncertainty and must be interpreted in the light of the stated assumptions and caveats.

Age model

Figure 7 shows the actual and projected proportions of the opiate treatment population by age group at five-yearly intervals. This shows that at the end of 2005 the largest proportion of opiate users in treatment were in the 30-39 age group (43%), followed by those under 30 (35%). By the end of 2015, the 30-39 age group remains the largest group (39%), but the 40-49 age group has increased from 17% to 37%, with the proportion under 30 falling to 8%. The projection for the end of 2020 suggests a continuation this pattern of an ageing population, with the 40-49 age group becoming the largest (43%), the 30-39 and 50-59 age groups being similar to one another in size (around 24%) and the under 30 age group falling further (3%).

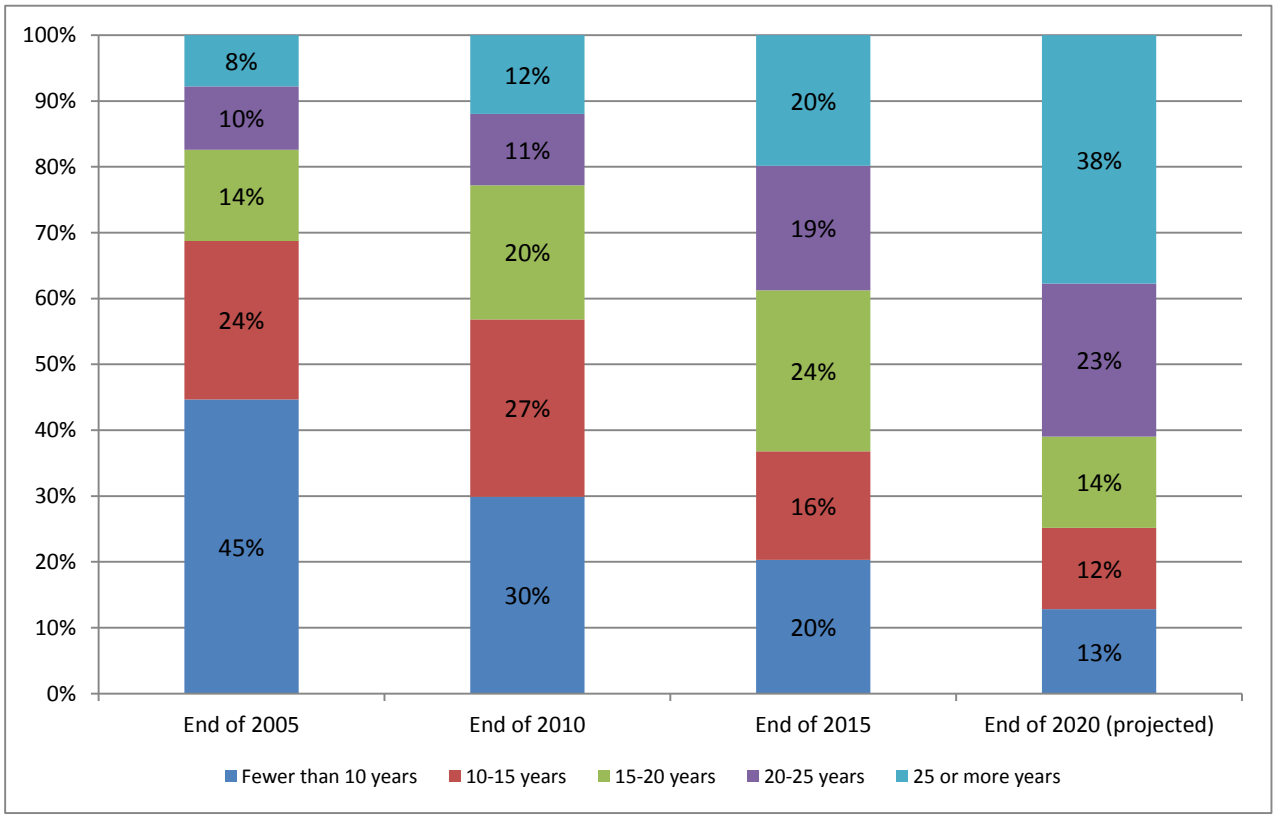
Figure 7. Actual and projected proportions of the opiate treatment population by age group (2005 to 2020)



Opiate use career model

Figure 8 shows the actual and projected proportions of the opiate treatment population by using career at five-yearly intervals. At the end of 2005, the largest proportion of opiate users in treatment had been using for fewer than 10 years (45%), followed by 10-14 years (24%). By the end of 2015, the proportion using for fewer than 10 years had fallen to 20%, and the largest proportion had been using for 15-19 years (24%). The projected figures for 2020 suggest a continuation of this trend, with nearly two-fifths (38%) of those in treatment predicted to have been using for at least 25 years, and a further 23% using for between 20-25 years.

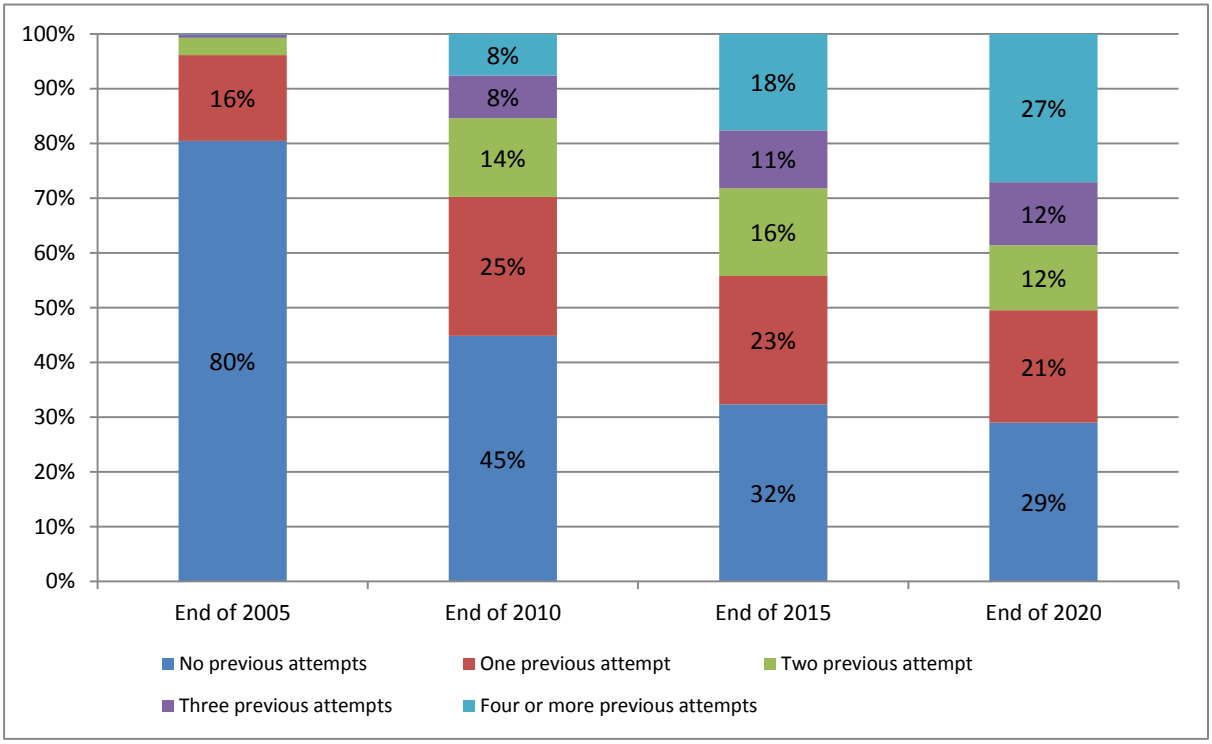
Figure 8. Actual and projected proportions of the opiate treatment population by opiate use career (2005 to 2020)



Model by previous attempts at treatment

Figure 9 shows the actual and projected proportions of the opiate treatment population by number of previous attempts at treatment at five-yearly intervals. For consistency with the other breakdowns, projections were calculated up to December 2020 based on the proportions of the population that had each number of previous attempts at treatment or more as at the start of each month starting at December 2005. At the end of 2005, four-fifths (80%) of opiate users in treatment had not accessed treatment for opiate use prior to their current treatment journey. By the end of 2015, this had fallen to one-third (32%), with a growing proportion having had four or more previous attempts at treatment (18%). The projected figures for 2020 suggest that the proportion with four or more previous attempts at treatment will rise to 27% while the proportion with no previous treatment will fall to 29%.

Figure 9. Actual and projected proportions of the opiate treatment population by previous attempts at treatment (2005 to 2020)



Projections for non-opiate treatment

Main models

The models for non-opiates were constructed for the period January 2011 to August 2016. The final model was tested by repeating the full model for the period January 2011 to August 2014, projecting through September 2014 to August 2016 and comparing this to the actual figures over this time.

The breakdown of non-opiate presentations to and exits from treatment is shown in Figure 10. Unlike the equivalent figures for opiates, the majority of exits from treatment for non-opiates are completions (57% of all exits in the period), while even towards the end of the period the majority of presentations to treatment are treatment naïve (63% of all presentations in the period), with far fewer re-presentations.

Figure 10. Non-opiate monthly treatment entry and exits (September 2014 to August 2016)

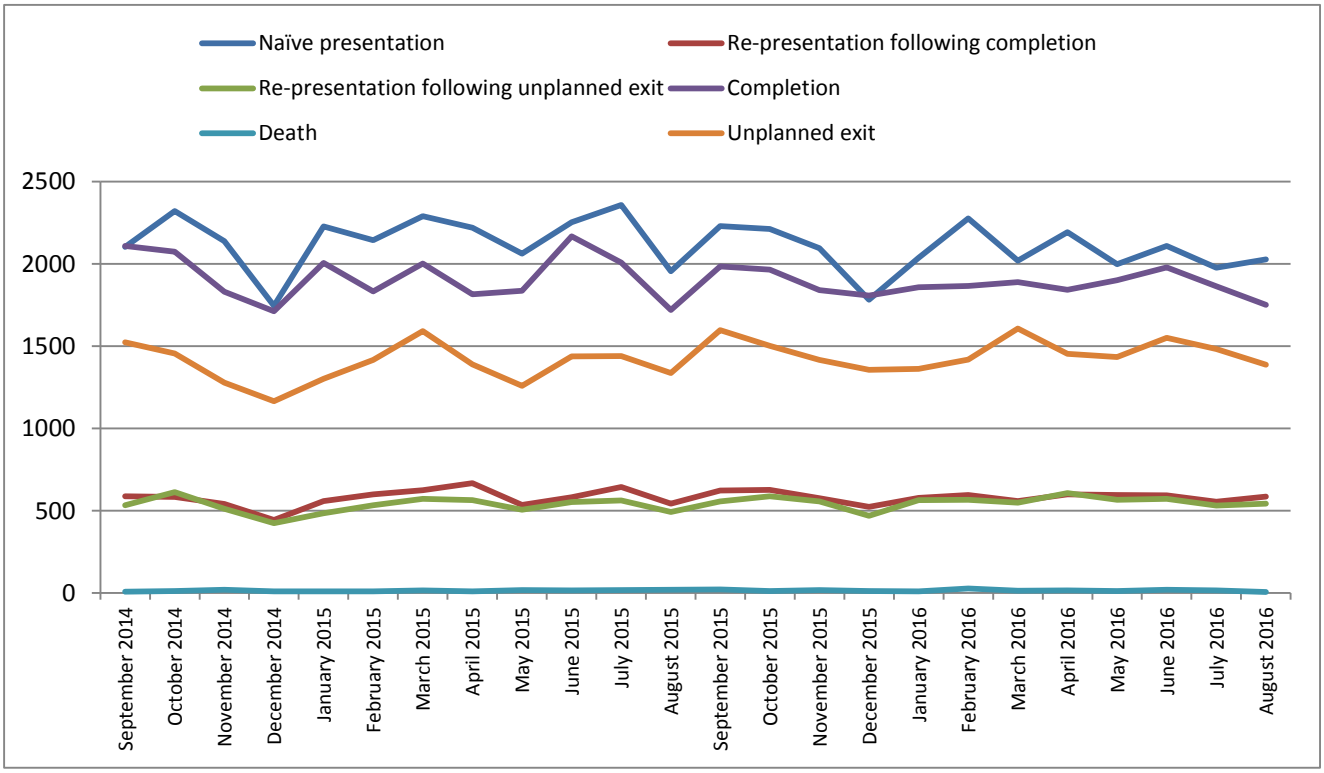
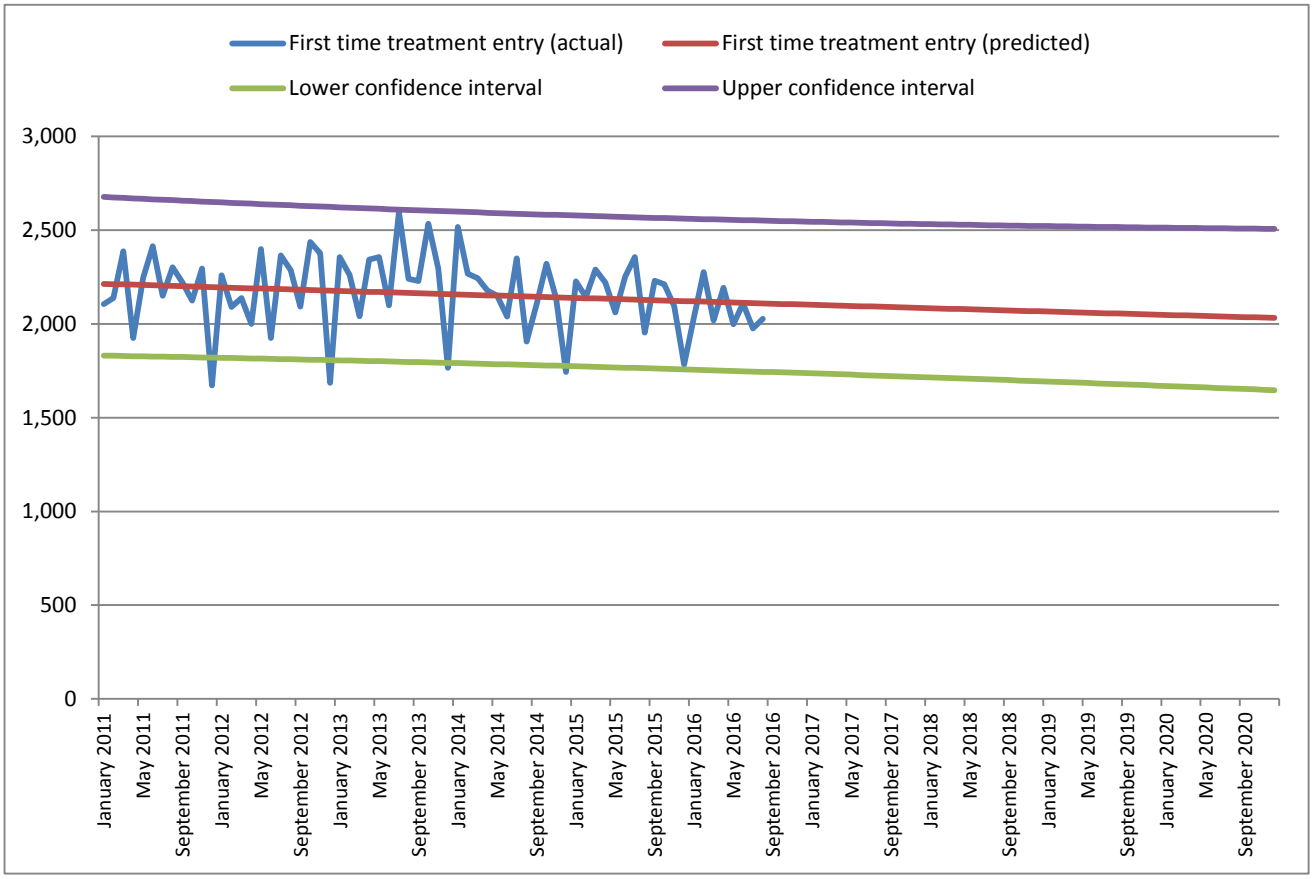


Figure 11 (overleaf) shows the actual and projected numbers of treatment naïve presentations for non-opiates. It can be seen that these fluctuate and peaked with 2,596 in July 2013 but have generally fallen in recent years. They are projected to fall to around

2,032 a month by December 2020 (95% CI: 1,647 to 2,507), having averaged 2,079 per month in the 12 months up to August 2016.

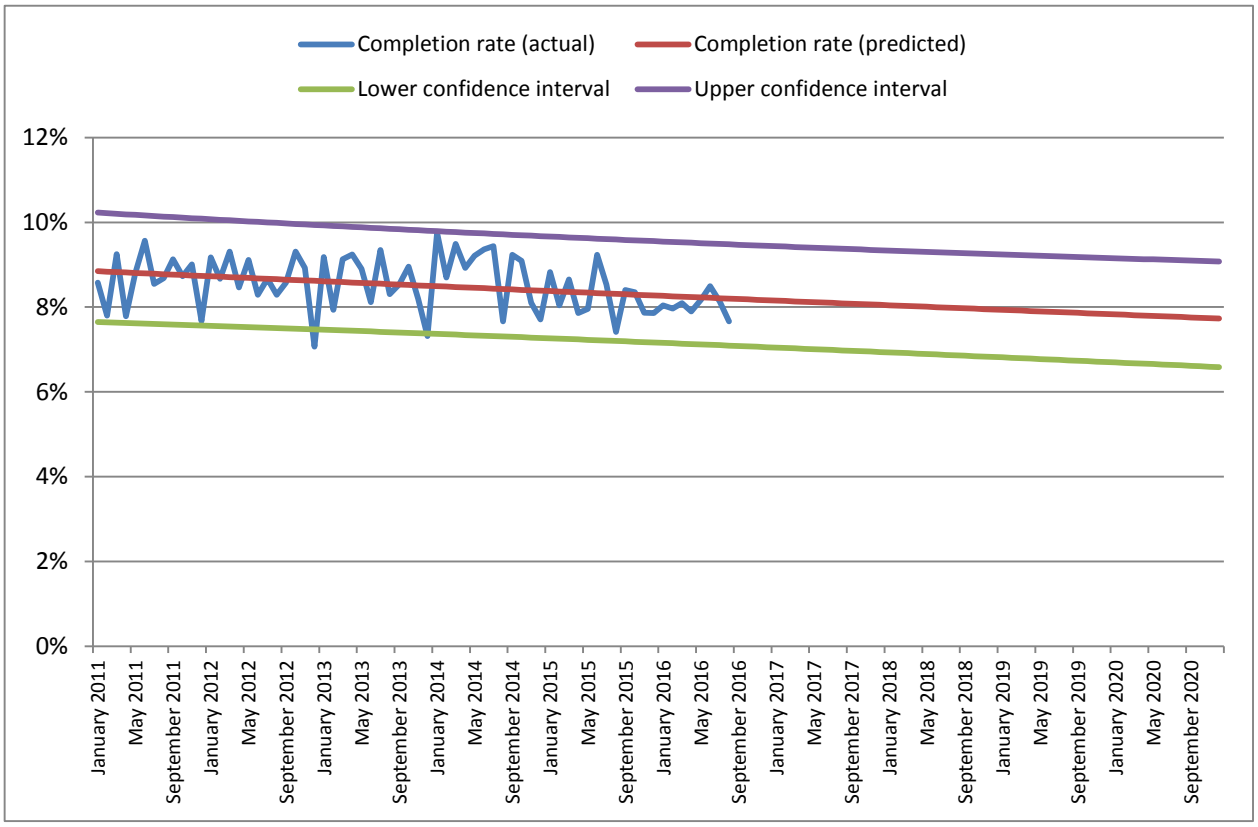
Figure 11. Actual and projected treatment naïve non-opiate presentations (January 2011 to December 2020)



As in the opiate models, the number of completions, unplanned exits and deaths shown in Figure 10 were converted to rates in each month, to take into account changes in the size of the overall population and provide a steadier estimate, and it should be noted that these monthly rates will be much lower than equivalent annual rates.

Figure 12 (overleaf) shows the actual and projected numbers of non-opiate treatment completions. The completion rate has gradually fallen over this period, to an average of 8.1% in the 12 months to August 2016. This is projected to fall to 7.7% by December 2020 (95% CI: 6.6% to 9.1%).

Figure 12. Actual and projected non-opiate completion rates (January 2011 to December 2020)



Actual and predicted unplanned exit rates from treatment for non-opiate use are shown in Figure 13 (overleaf). Unplanned exit rates for non-opiates have steadily risen across the period, to an average of 6.3% in the 12 months up to August 2016. These are projected to rise further 6.7% in December 2020 (95% CI: 5.6% to 8.1%).

Figure 13. Actual and projected rates of unplanned exits from non-opiate treatment (January 2011 to December 2020)

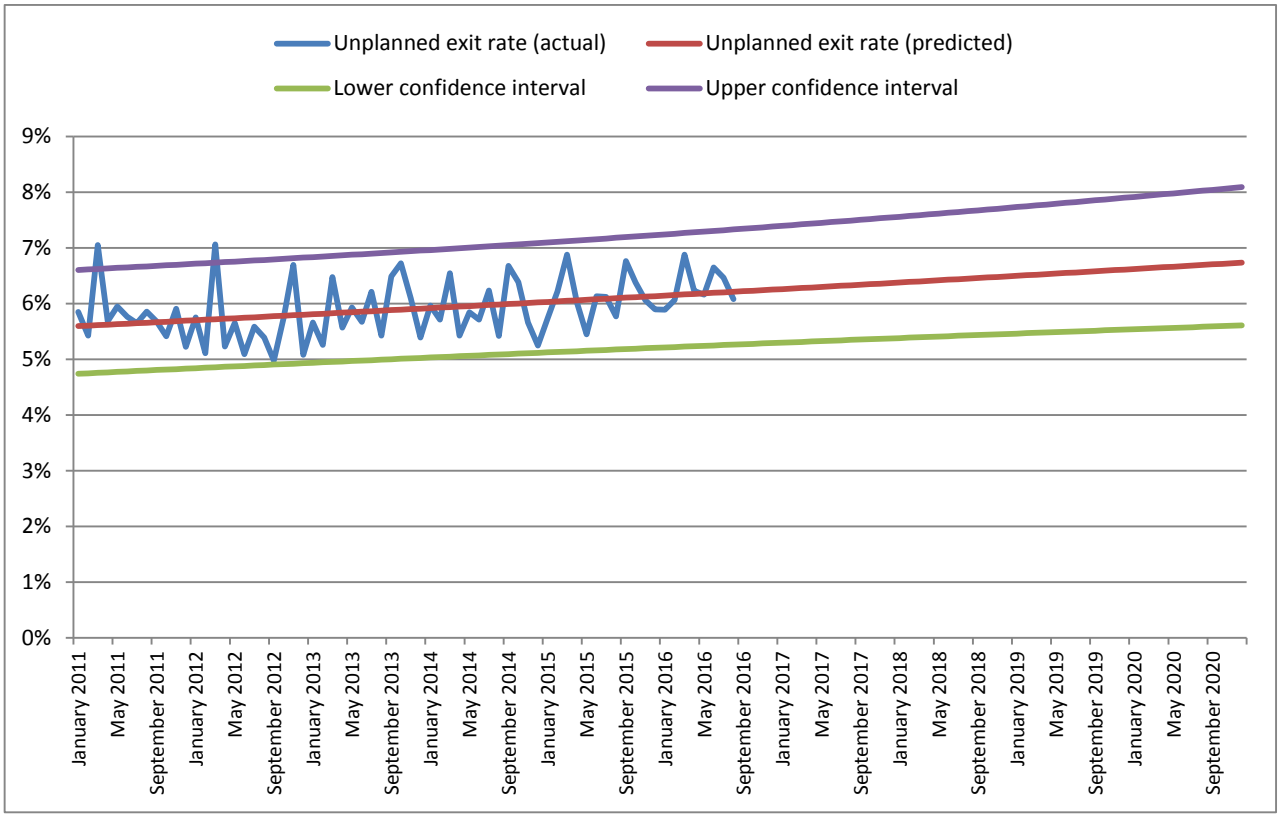


Figure 14 (overleaf) shows actual and predicted mortality rates for non-opiate users in treatment. These are much lower than the equivalent rates for opiate users. The average monthly mortality rate in non-opiate treatment was 0.07% in the 12 months up to August 2016, but shows signs of increasing and is projected to increase to 0.09% (95% CI: <0.01% to 0.17%) by December 2020.

Figure 14. Actual and projected mortality rate in treatment for non-opiates (January 2011 to December 2020)

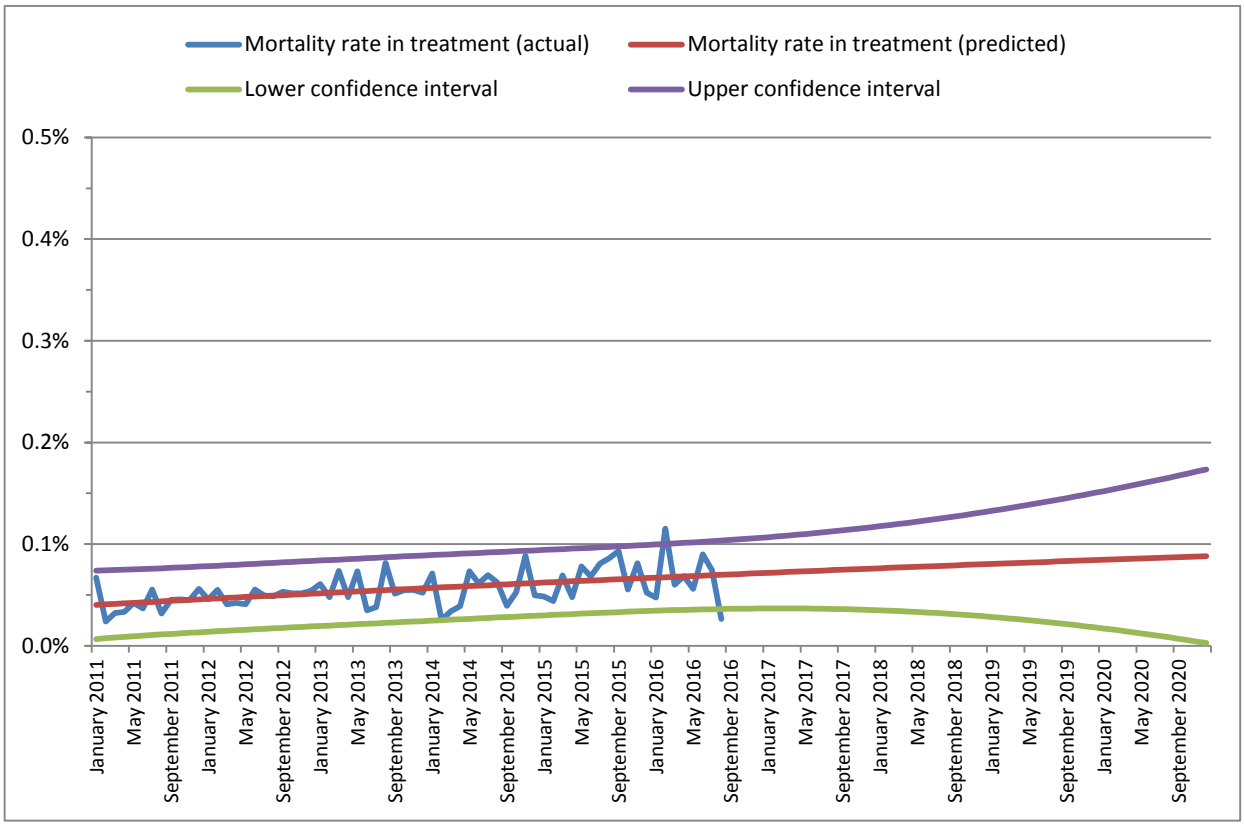
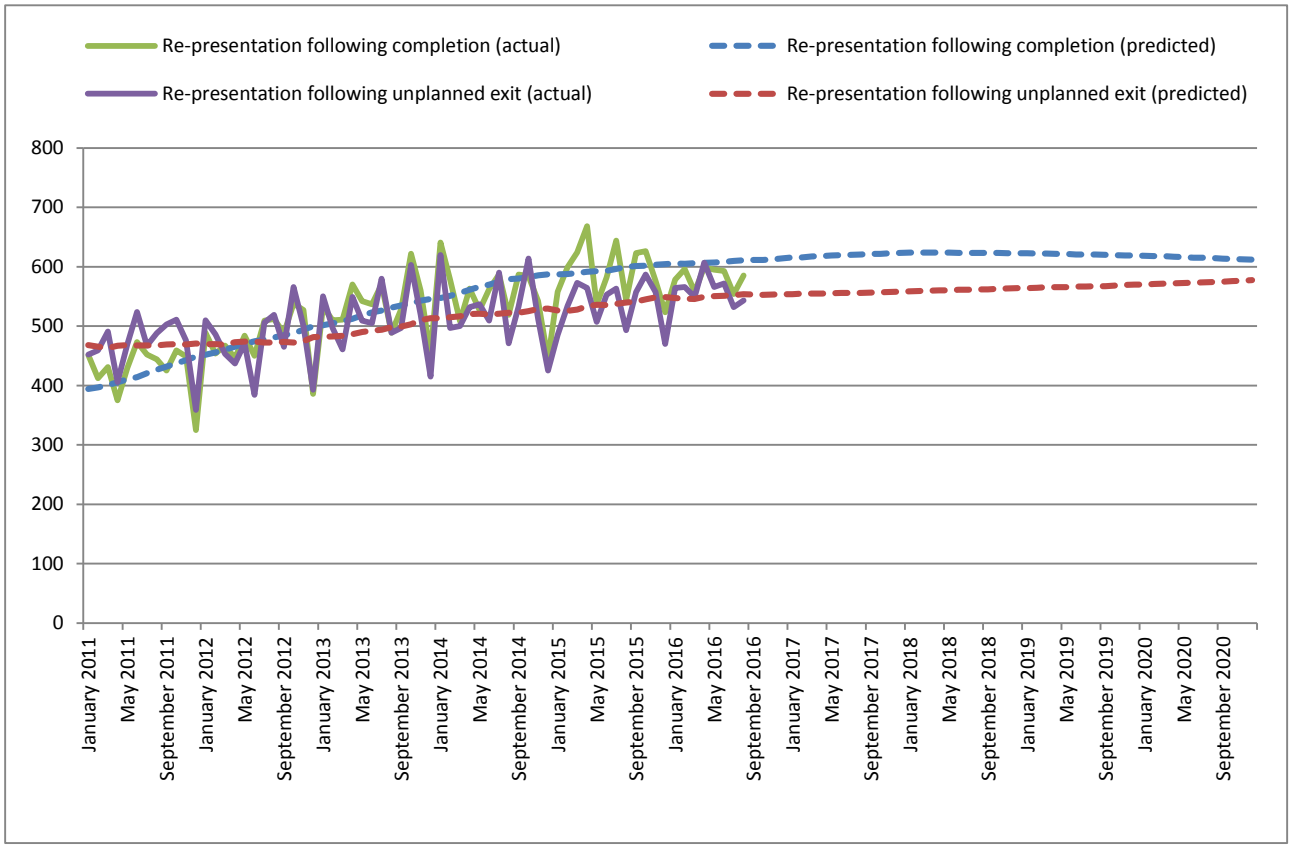


Figure 15 (overleaf) shows the actual and projected re-presentation rates following unplanned exits and completions over this period. Similarly to the opiate models, the projected re-presentations for non-opiate use show broad parity with the actual numbers of re-presentations. The number of re-presentations is projected to remain broadly similar both for re-presntations following unplanned exits and following treamtent completions. Again, similarly to the opiate models, it should be borne in mind that the later projected re-presentations will be based on projected completion and unplanned exit rates, and hence reflect the directions of travel shown in those models.

Figure 15. Actual and projected number of re-presentations following completion or unplanned exit from non-opiate treatment (January 2011 to December 2020)



Testing of main models

The main non-opiate models were tested for the period September 2014 to August 2016. For this, we ran identical models on the period January 2011 to August 2014 and projected through to August 2016. On 1 September 2014, there were 19,483 adult non-opiate users in treatment and on 1 September 2016 this had slightly increased, to 19,681. Using the central estimates from each of the main non-opiate models led to a projected number in treatment on 1 September 2016 of 20,040. Therefore, the models projected a larger rise in treatment numbers than occurred.

It should be noted that non-opiate users have much shorter spells in treatment on average than opiate users, meaning that the volatility of the models has a much greater effect when seeking to predict an overall treatment number at any given point. The net increase of 198 in non-opiate treatment numbers is accounted for by 80,366 presentations to treatment compared to 80,168 exits. The models projected a net increase of 557, based on 83,186 presentations and 82,629 exits.

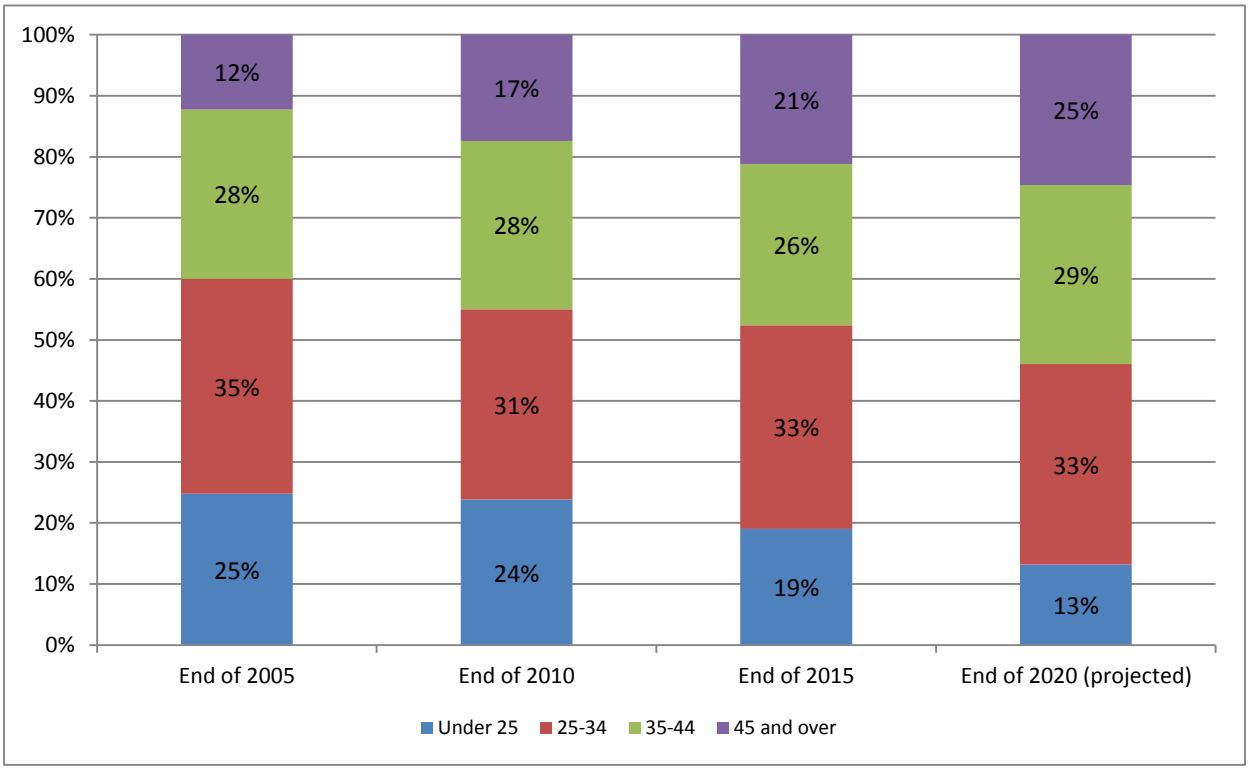
Summary of main models

In summary, the different models suggest that the factors which influence overall numbers in non-opiate treatment – naïve presentations, treatment exits for different reasons and re-presentations following those exits – will each continue to increase or decrease generally in keeping with current trends. Overall, these projections suggest that treatment numbers will continue to remain at a similar level to now, and this is consistent with what we have seen in recent years.

Age model

Figure 16 shows the actual and projected proportions of the adult non-opiate treatment population by age group at five-yearly intervals. As with the equivalent model for opiates, this was estimated by projecting the proportions at each age group or higher as at each month. This shows that the largest group of non-opiate users are aged 25-34 (33% at the end of 2015) and, although this proportion is projected to fall slightly, they are still projected to remain the largest group by December 2020 (33%). The proportion of the non-opiate population aged 18-24 has fallen from 25% in 2005 to 19% in 2015 and is projected to fall further to 13% by the end of 2020, while the population aged 45 or over has increased from 12% in 2005 to 21% in 2015 and is projected to rise further to 25% by the end of 2020. Therefore, the non-opiate population is experiencing an ageing trend, but not as acute as that seen in the opiate population.

Figure 16. Actual and projected proportions of the non-opiate treatment population by age group (2005 to 2020)



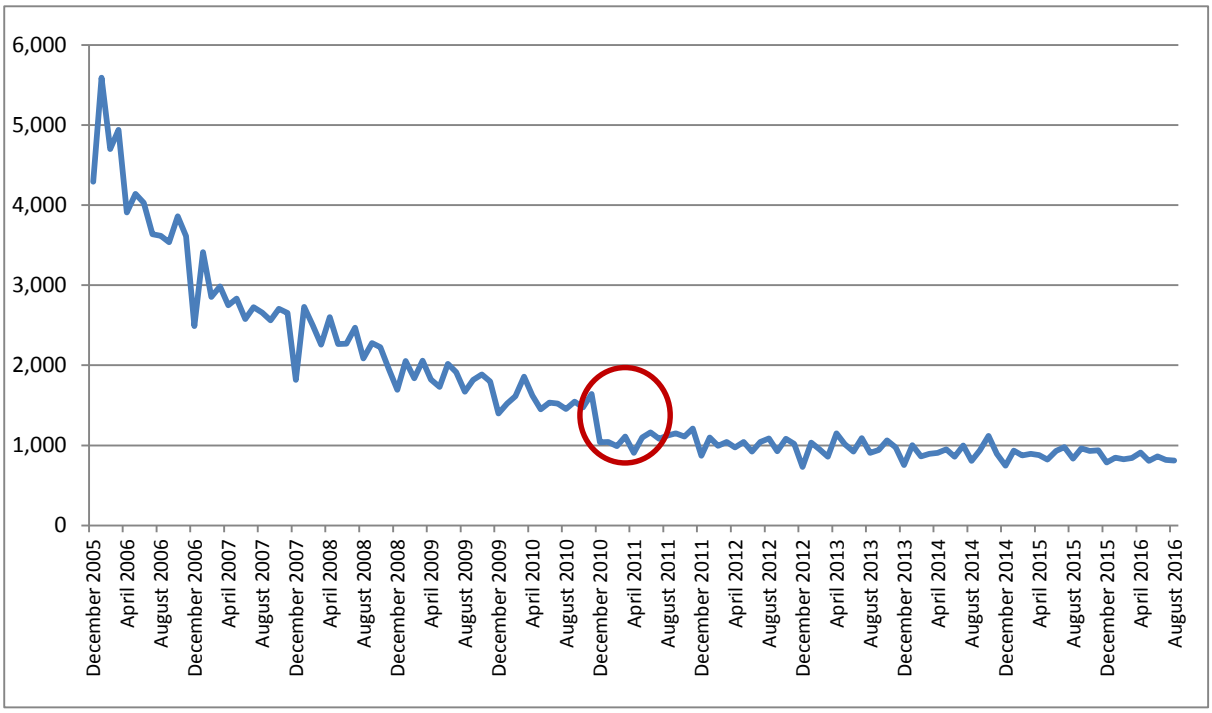
Reasons for truncation of the time period for main models

In the final analysis, the time period used for the main models was truncated to January 2011 to August 2016, reducing the amount of retrospective data available. This is due to a significant change in the time series starting in late 2010, at the time of a purported heroin shortage.[3]

Figure 17 shows treatment naïve opiate presentations starting at December 2005. The large fall in treatment naïve presentations in December 2010 is highlighted by the red oval. It is evident from this graph that the long-term trend of falling naïve presentations was interrupted at this point and that following this there has been a different, steadier and shallower, decreasing trend. This means that it is not sensible to use the whole time series to project naïve presentations, because this would lead to overestimates at the start of 2011 and then substantial underestimates by the end of 2015.

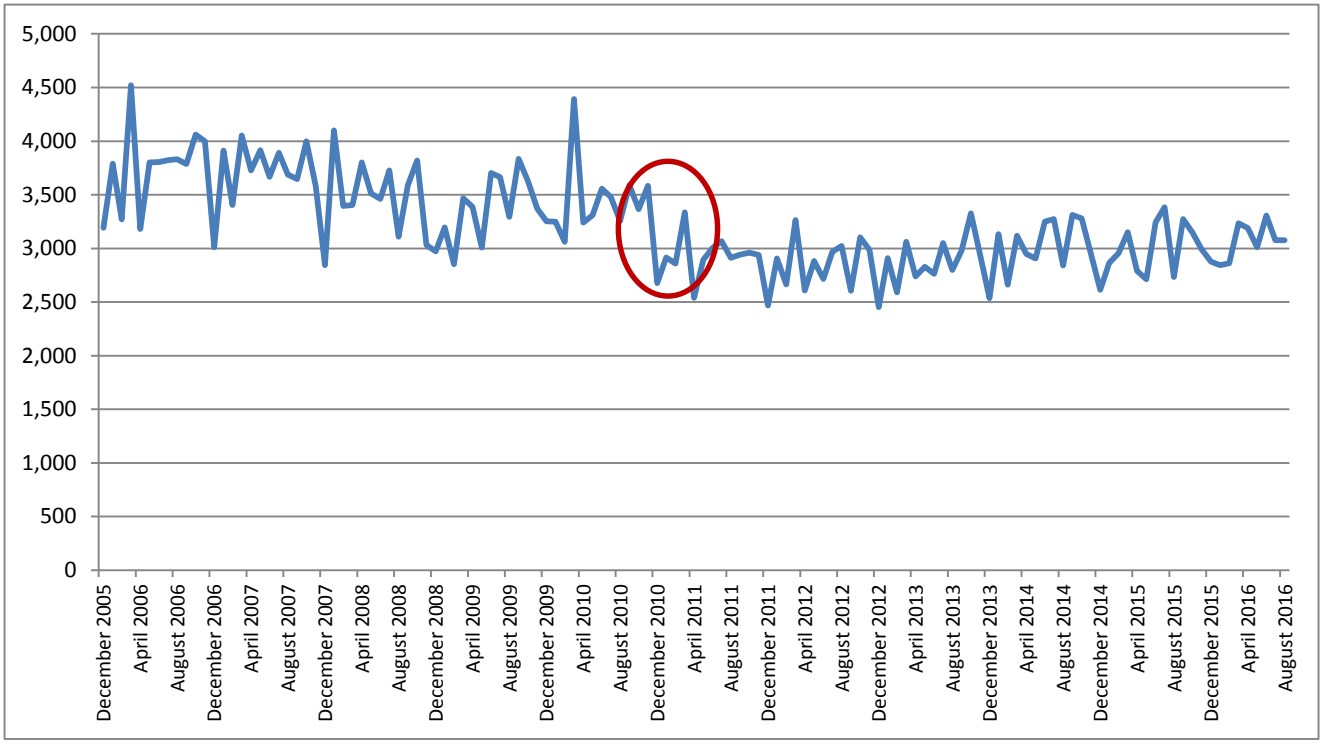
It should be noted also that the earlier part of the declining trend from 2005 will be overstated because many presentations in the early months will have had treatment previously, which has not been captured because it was prior to the start point for this analysis (and possibly predates NDTMS as a system for capturing treatment activity).

Figure 17. Naïve opiate presentations by month (December 2005 to August 2016)



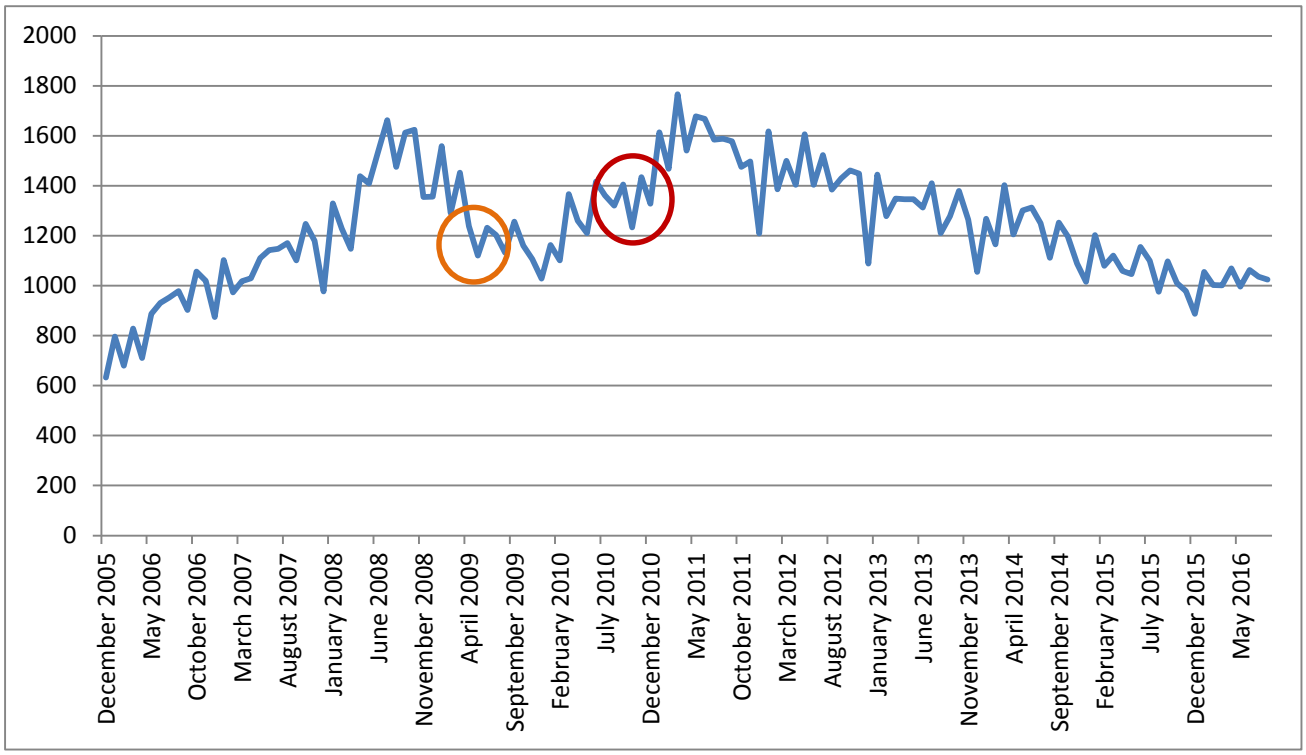
A similar pattern can be seen when considering people who had an unplanned exit from December 2005 onwards in Figure 18 (overleaf). Here, the number of monthly unplanned exits fell sharply in late 2010 and early 2011 (highlighted by the red oval). In general, unplanned exits have remained comparatively low since this point.

Figure 18. Opiate treatment unplanned exits by month (December 2005 to August 2016)



The trend in treatment completions shown in Figure 19 (overleaf) is more varied over time. The number of treatment completions peaked in March 2011, although unlike other indicators there is not an obvious rise or fall around late 2010, with an ongoing, increasing trend through this point. However, there is a definite and fairly steady decreasing trend since March 2011. The decline that preceded the increase from late 2009 to March 2011 is probably due to changes in coding that were introduced in April 2009 (highlighted by the orange oval), which made the criteria for completing an opiate user from treatment more rigorous.

Figure 19. Opiate treatment completions by month (December 2005 to August 2016)



Taken together, these patterns suggest that the trends in opiate treatment activity in the six years from January 2011 are not consistent with the trends prior to this point. This is why we have chosen to truncate the retrospective data used to January 2011. However, it should be noted that truncating the follow-up period to this extent should mean that subsequent projections are regarded with greater uncertainty, because they are based on a much smaller amount of retrospective data. In effect, these models assume that the situation between 2011-2016 will be maintained for the following four years.

There were also falls in re-presentations to treatment following both completions and unplanned exits at the time of the purported heroin shortage, which the modelled re-presentation figures do not predict. However, these estimates seem to predict more recent figures with a high degree of accuracy.

For consistency, the same truncation of the time period was applied to the non-opiate models, although there is not the same direct effect.

References

1. Hay G, Rael dos Santos A, Worsley J. Estimates of the Prevalence of Opiate Use and/or Crack Cocaine Use, 2011/12: Sweep 8 report [Internet]. 2012 [cited 2016 Jun 5]. Available from: http://www.nta.nhs.uk/uploads/estimates-of-the-prevalence-of-opiate-use-and-or-crack-cocaine-use-2011-12.pdf

2. Morgan N, Heap D, Elliott A, Millar T. New opiate and crack-cocaine users: characteristics and trends Nick Morgan, Daniel Heap, Amy Elliott, Tim Millar. Home Office; 2016 Jan. Report No.: Research Report 90.

3. Ahmad M, Richardson A. Impact of the reduction in heroin supply between 2010 and 2011. Home Office; 2016 Jan. Report No.: Research Report 91.