Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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Supplementary material

Section S1. Details of data cleaning methods.

Dispensing data

Dispensing data were supplied by the pharmacy contractor as CSV files covering monthly or quarterly and comprising individual dispensing events. These data were appended together to obtain a dataset covering the study period and subsequently checked for duplicates and missing values. Dispensing dates were converted to week-year and fortnight-year values, with each week or fortnight period beginning on a Sunday. Dates and quantities were checked for implausible values using summary statistics and visual methods.

A consistent set of prison names were derived, correcting for misspellings; case differences; and use of hall names rather than overall institutions. Time series of dispensing quantities and rates were plotted for each prison and overall by daily, weekly, and fortnightly date as well as by day of the week and month of the year in order to check for consistency and any errors or outliers.

Relevant medications were identified by a combination of automatic searching of BNF subchapter and product name fields, and hand-searching of product name field. A manual check of product names included under each category was undertaken to complete this process. Datasets were created for each level 1 and level 2 medication category, containing dispensed quantities overall and by prison, by week-year and fortnight-year, with indicator variables to identify whether each time period fell during the pre-announcement, anticipatory, or post-implementation phase. Separate totals were calculated for the closed prison estate (primary analyses) and the entire prison estate including the one open prison (secondary analyses).

Population data

Population data were supplied by Scottish Prison Service in PDF files which were converted to CSV files using the Tabula (https://tabula.technology/) programme and hand-checked by two authors. These were appended together to obtain a dataset covering the study period and subsequently checked for duplicates and missing values.

Time series of population counts (used as denominators for dispensing rates, and numerators for the crowding indicator variable) and contracted capacity (used as denominators for the crowding indicator variable) were plotted for each prison and overall by daily, weekly, and fortnightly date as well as by day of the week and month of the year in order to check for consistency and any errors or outliers. Separate totals were calculated for the closed prison estate (primary analyses) and the entire prison estate including the one open prison (secondary analyses).

A crowding indicator was calculated using population count divided by contracted capacity, by prison and overall.

Combination of dispensing data and population data to create dispensing rates

Files containing dispensing data and population data were merged and new variables created to calculate dispensing rates per week and per fortnight for each prison, the closed prison estate as a whole (primary analyses), and the entire prison estate including the one open prison (secondary analyses). Times series of mean dispensing rates for each level 1 and level 2 medication category by week and by fortnight were plotted to check for consistency and any errors or outliers.
Section S2.1. Criteria for selection of medication categories as outcomes of interest for evaluating the intended and unintended consequences of the smokefree prison policy

- Indicators of attempts to quit or abstain from smoking, or of a health condition with potential to be affected by one or more of the following:
  - Smoking status;
  - Exposure to SHS;
  - Other, unintended consequences of the policy.
- Unlikely to be confounded by co-occurring changes in demand or dispensing practice
- Responsive to change within the one-year follow up post-intervention
- Likely to be dispensed in quantities sufficient to provide adequate statistical power

Section S2.2. Rationale for not including opioid substitution therapy (OST) as a medication category among the outcomes of interest

In response to reviewer feedback, we include here a detailed rationale for not including OST as a medication category of interest among the study outcomes.

Opioid dependence is a prevalent condition among people in custody and there are potential unintended consequences of smokefree policies on this population with regard to the severity of their dependence and demand for substitution therapies. This might result in a change in the dosage of methadone dispensed for an individual in response to policy implementation, although is unlikely to have a significant effect on the number of individuals with opioid dependence for whom OST is indicated or their motivation for or access to treatment.

However, there are a number of potential issues which complicate the use of OST dispensing as an indicator of unintended consequences. The metabolism – and therefore the serum levels and appropriate dosage – of methadone and other forms of opioid is affected
by exposure to polycyclic aromatic hydrocarbons found in tobacco smoke (see for instance, Wahawisan et al 2011 - https://doi.org/10.1345/aph.1P759). The dramatic reduction in levels of second-hand smoke demonstrated quantitatively in other strands of the TIPs project (e.g. Demou et al 2020 - https://doi.org/10.1093/annweh/wxaa073) means that lower doses may have been required to achieve the same effect among PiC following the intervention. There were also a number of concurrent unrelated trends and events which may affect OST dispensing during the study period, including ongoing public debates about the benefits and risks of OST; concerns about rising drugs deaths; the launch of an updated drug treatment strategy by Scottish Government; and the publication of new UK-wide clinical guidelines on drug treatment, including OST use.

For all these reasons, we decided a priori not to include OST in our planned analyses, prior to reviewing the data or undertaking any analysis. This position was informed by discussions with one of our co-authors (TB) who is National Prisons Pharmacy Adviser for Scotland, who strongly advised against use of the dispensing data for OST as an outcome for the evaluation for the reasons outlined above.
### Section S3. Amendments to original protocol and rationale

| Amendment                                                                 | Rationale                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analysis of hospitalisations omitted from project as not feasible due to data quality issues. | Data quality issues with the recording of address details in SMR01 (Scottish Morbidity Record 01; source of data on general and acute inpatient and day case hospital stays in Scotland) meant that our primary approach for identifying people admitted to hospital from custody using prison postcodes was not reliable for the study period of interest. Given that other methods of identifying people admitted to hospital from prison from within the SMR01 dataset itself also had important limitations, and there was insufficient time to undertake individual-level data linkage between prison records and SMR01, we were required to omit the hospitalisations analysis from the project. |
| Use of fortnightly intervals for time series in primary analyses rather than weekly. Models for weekly data run as a secondary, 'per-protocol' analysis and shown in supplementary material. | On receipt of dispensing data, it was found to show substantial week-to-week variation which complicated the identification of appropriate time series properties. Fortnightly data felt to be more appropriate for identifying underlying time series properties and trends, and modelling intervention. |
| Study period to start from 30th March 2014 rather than 1st January 2013 | 2013 and early 2014 saw significant changes to the prison system in north-east Scotland, with the closure of two prisons (HMP Peterhead and HMP Craiginches and the opening of another (HMP Grampian). In order to exclude artefactual changes in dispensing associated with prison closure and opening and ensure a consistent series of prisons included in the analyses, the study period has been amended to begin one month after the opening of HMP Grampian. |
| Data from one prison on dispensing of nicotine replacement therapy and combined nicotine dependence category omitted from analyses of these outcomes | It was identified after protocol submission that nicotine replacement therapy in this prison is primarily provided by an in-reach service run by the local health board rather than being dispensed via the national pharmacy contract, so will not be captured in our data. In-reach data collected differently and may not be complete, so we decided against including it in the series. Instead, results from this prison are omitted from analyses of relevant outcome categories (nicotine replacement therapy and combined nicotine dependence category). |
| Restriction of respiratory category to short-acting inhaled bronchodilators and antibiotics; restriction of cardiovascular category to short-acting nitrate formulations | Protocol did not specify whether inhaled bronchodilators (respiratory category) and nitrates (cardiovascular) included both short-acting and long-acting preparations. Protocol also included inhaled corticosteroids, which are used for long-term control of obstructive airways disease. Demand for long-acting bronchodilators, inhaled corticosteroids, and long-acting nitrate formulations was felt to be unlikely to change in response to changes in tobacco smoke exposure and therefore less appropriate indicators of intervention effectiveness. Prior to data analysis, we therefore decided to omit these medications and restrict analyses to short-acting bronchodilators and antibiotics (respiratory category) and short-acting nitrate formulations (cardiovascular category) only. |
| Addition of hypnotics/anxiolytics category to mental health analysis in response to reviewer feedback | Request from reviewers to investigate potential changes in this category. Multiple indications for hypnotics/anxiolytics but no major confounding trends during study period identified a priori, so analyses undertaken in response to this request. |
### Section S4. Dispensed quantities and mean dispensing rates per 1000 persons in custody for relevant medication categories in closed prisons during each study phase

|                              | Overall study period (30/03/2014 – 30/11/2019) | Pre-announcement phase (30/03/2014 – 17/07/2017) | Anticipatory phase (18/07/2017 – 29/11/2018) | Post-implementation phase (30/11/2018 – 30/11/2019) |
|------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|---------------------------------------------------|
|                              | Number of dispensed items | Mean dispensing rate per 1000 PiC (95% CI) | Number of dispensed items | Mean dispensing rate per 1000 PiC (95% CI) | Number of dispensed items | Mean dispensing rate per 1000 PiC (95% CI) | Number of dispensed items | Mean dispensing rate per 1000 PiC (95% CI) |
| Smoking cessation/abstinence attempts: treatment for nicotine dependence | | | | | | | | |
| All                          | 3,324,178 | 1,464.3 (1,242.5 – 1,686.0) | 1,012,117 | 795.5 (731.7 – 859.3) | 663,647 | 1,277.2 (977.6 – 1,576.7) | 1,648,414 | 3,837.0 (3,294.9 – 4,379.1) |
| Nicotine replacement therapy  | 3,146,853 | 1,383.7 (1,160.1 – 1,607.2) | 917,080 | 720.8 (658.4 – 783.1) | 597,066 | 1,148.7 (852.4 – 1,444.9) | 1,632,707 | 3,799.7 (3,259.6 – 4,339.9) |
| Other (varenicline/bupropion) | 177,325 | 80.6 (73.7 – 87.5) | 95,037 | 74.7 (70.0 – 79.4) | 66,581 | 128.5 (118.3 – 138.7) | 15,707 | 37.2 (18.5 – 56.0) |
| Smoking-related illnesses     | | | | | | | | |
| All                          | 16,850,875 | 7,598.5 (7,481.4 – 7,650.7) | 9,794,791 | 7,688.7 (7,526.7 – 7,850.7) | 4,049,281 | 7,840.1 (7,650.6 – 8,029.6) | 3,006,803 | 6,998.1 (6,823.7 – 7,172.6) |
| Respiratory                  | 9,395,092 | 4,238.5 (4,160.7 – 4,316.3) | 5,496,581 | 4,313.7 (4,216.8 – 4,410.6) | 2,297,430 | 4,477.2 (4,326.9 – 4,657.6) | 1,601,081 | 3,782.3 (3,591.6 – 3,865.1) |
| Cardiovascular               | 602,035 | 271.8 (255.9 – 287.7) | 380,020 | 298.6 (276.5 – 320.6) | 126,970 | 314.1 (297.3 – 331.9) | 95,045 | 221.1 |
| Gastrointestinal             | 6,838,487 | 3,081.3 (3,023.6 – 3,139.0) | 3,908,444 | 3,068.8 (2,985.4 – 3,152.1) | 1,621,528 | 3,141.1 (3,027.1 – 3,255.1) | 1,308,515 | 3,043.7 (2,940.2 – 3,147.2) |
| Sensory                      | 15,261 | 6.9 (6.4 – 7.4) | 9,746 | 7.6 (7.1 – 8.2) | 3,353 | 6.5 (5.5 – 7.5) | 2,162 | 5.9 (5.6 – 6.2) |
| Mental health: anti-depressants | | | | | | | | |
| All                          | 9,214,162 | 4,139.2 (4,104.0 – 4,763.5) | 4,728,469 | 3,714.8 (3,590.0 – 3,839.6) | 2,318,877 | 4,485.9 (4,327.3 – 4,644.6) | 2,166,817 | 5,041.5 (4,824.2 – 5,258.9) |
| SSRI anti-depressants         | 2,073,327 | 932.3 (908.5 – 956.2) | 1,119,881 | 879.8 (849.2 – 910.5) | 498,101 | 963.6 (931.7 – 995.5) | 455,345 | 1,059.1 (1,008.3 – 1,109.8) |
| Hypnotics/anxiolytics         | 1,823,174 | 870.7 (799.8 – 841.6) | 1,034,614 | 811.8 (785.5 – 838.2) | 430,046 | 832.1 (779.5 – 884.7) | 358,514 | 834.4 (789.8 – 879.2) |
| Control series                | | | | | | | | |
| Anti-epileptics               | 1,885,990 | 848.4 (829.6 – 867.2) | 1,018,353 | 799.4 (77.6 – 821.3) | 469,112 | 907.8 (874.6 – 941.0) | 398,493 | 927.3 (886.8 – 967.7) |
### Section S5. Model specification for primary analyses

| Outcome of interest                                      | AR/MA terms | Seasonal terms | Any outliers                                                                 |
|----------------------------------------------------------|-------------|----------------|-------------------------------------------------------------------------------|
| All nicotine dependence                                  | AR(1,2,7)   | None required  | Outlier term for bulk dispensing event in fortnight commencing (f/c) 15/07/2018 |
| Nicotine replacement therapy                             | AR(1,2)     | None required  | Outlier term for bulk dispensing event in f/c 15/07/2018                      |
| Other medications for nicotine dependence (varenicline/bupropion) | AR(1,2,11)  | Seasonal term of AR(1) at interval of one year | Outlier term for bulk dispensing event in f/c 15/07/2018                      |
| All smoking-related illness                              | AR(1,14)    | None required  | Outlier term for bulk dispensing events in f/c 21/12/2014 & f/c 06/12/2015   |
| Smoking-related illness: respiratory                     | AR(1,9,14,15,28) | None required | Outlier term for bulk dispensing event in f/c 06/12/2015                      |
| Smoking-related illness: cardiovascular                  | None required | None required  | None required                                                                |
| Smoking-related illness: gastrointestinal                | None required | None required  | None required                                                                |
| Smoking-related illness: sensory                         | AR(1)       | None required  | Outlier term for bulk dispensing event in f/c 07/05/2017                      |
| Mental health: all anti-depressants                       | AR(1)       | Seasonal term of AR(1) at interval of one year | None required                                                                |
| Mental health: SSRI only                                 | None required | Seasonal term of AR(1) at interval of one year | None required                                                                |
| Mental health: hypnotics/anxiolytics (post-protocol analysis) | None required | Seasonal term of AR(1) at interval of one year | None required                                                                |
| Control: anti-epileptics                                 | AR(2,4)     | Seasonal term of AR(1) at interval of one year | None required                                                                |
Section S6. Full results table including secondary and post-protocol analyses: modelling of fortnightly dispensing rates per 1,000 persons in custody

| Step                        | Announcement | Implementation |
|-----------------------------|--------------|----------------|
|                             | Coefficient  | Coefficient    | Coefficient  | Coefficient  | AIC/  | Adj. |
|                             | (95% CI)     | (95% CI)       | (95% CI)     | (95% CI)     | BIC   | R²   |
| Closed prisons              | -204.8       | 12.6           | 2,249.6      | -2.6         | 0.901 | 2377 |
|                             | (1,564.7 – 1,155.2) | (28.1 – 53.4) | (1,874.9 – 2,624.4) | (-44.4 – 39.1) | 2370 | 80.2 |
| All prisons                 | -132.5       | 10.7           | 2443.8       | -6.7         | 0.731 | 2323 |
|                             | (1,388.7 – 1,123.7) | (35.0 – 56.3) | (2,053.3 – 2,834.2) | (-45.0 – 31.6) | 2356 | 82.3 |
| Adjusted for crowding       | -219.5       | 14.9           | 2255.1       | -1.7         | 0.934 | 2339 |
|                             | (1,570.5 – 1,131.6) | (32.8 – 62.7) | (1,880.9 – 2,629.2) | (-43.1 – 39.6) | 2375 | 80.3 |
| Delayed implementation      | -762.2       | 61.9           | -359.6       | 30.5         | 0.207 | 2372 |
|                             | (2,009.9 – 485.4) | (23.1 – 100.7) | (-874.2 – 154.9) | (-16.9 – 77.9) | 2399 | 74.7 |
| Weekly intervals            | -401.0       | 11.9           | 1,817.8      | -5.1         | 0.289 | 4957 |
|                             | (-976.1 – 174.0) | (2.9 – 20.9)   | (1,475.1 – 2,160.6) | (-14.6 – 4.4) | 5020 | 68.0 |

**ALL NICOTINE DEPENDENCE**

| Step                        | Announcement | Implementation |
|-----------------------------|--------------|----------------|
|                             | Coefficient  | Coefficient    | Coefficient  | Coefficient  | AIC/  | Adj. |
|                             | (95% CI)     | (95% CI)       | (95% CI)     | (95% CI)     | BIC   | R²   |
| Closed prisons              | -256.8       | 16.0           | 2,108.6      | 1.1          | 0.936 | 2336 |
|                             | (1,244.6 – 731.0) | (13.2 – 45.1) | (1,701.3 – 2,515.9) | (-26.1 – 28.3) | 2369 | 80.1 |
| All prisons                 | -181.1       | 9.9            | 2,410.2      | 7.1          | 0.763 | 2363 |
|                             | (1,660.2 – 1,338.0) | (39.8 – 59.6) | (2,008.9 – 2,811.5) | (-39.0 – 53.2) | 2363 | 82.2 |
| Adjusted for crowding       | -269.5       | 17.1           | 2,141.9      | 8.3          | 0.661 | 2340 |
|                             | (1,502.2 – 963.2) | (26.1 – 60.2) | (1,736.1 – 2,547.8) | (-28.7 – 45.3) | 2373 | 80.2 |
| Delayed implementation      | -750.1       | 61.2           | -314.5       | 37.2         | 0.155 | 2403 |
|                             | (2,018.7 – 518.5) | (19.5 – 102.9) | (-847.4 – 218.5) | (-14.1 – 88.4) | 2373 | 74.8 |
| Weekly intervals            | -298.3       | 11.1           | 1,889.5      | -1.8         | 0.762 | 4977 |
|                             | (-1,196.8 – 600.2) | (-3.8 – 26.1) | (1,489.9 – 2,289.2) | (-13.6 – 10.0) | 5047 | 66.7 |

**NICOTINE REPLACEMENT THERAPY**

| Step                        | Announcement | Implementation |
|-----------------------------|--------------|----------------|
|                             | Coefficient  | Coefficient    | Coefficient  | Coefficient  | AIC/  | Adj. |
|                             | (95% CI)     | (95% CI)       | (95% CI)     | (95% CI)     | BIC   | R²   |
| Closed prisons              | -4.9         | 0.1            | 48.2         | -9.1         | 0.001 | 1244 |
|                             | (-46.3 – 35.6) | (-2.1 – 2.3)   | (20.0 – 75.6) | (-14.4 – 3.8) | 1280 | 87.5 |
| All prisons                 | -7.3         | 0.9            | 49.8         | -7.4         | 0.001 | 1288 |
|                             | (-66.6 – 52.0) | (-2.6 – 2.6)   | (4.9 – 53.3) | (-11.6 – 3.2) | 1321 | 82.7 |
| Adjusted for crowding       | -4.1         | 0.0            | 49.8         | -9.6         | 0.002 | 1242 |
|                             | (-46.9 – 38.6) | (-2.7 – 2.0)   | (12.8 – 86.8) | (-15.8 – 3.5) | 1281 | 87.8 |
| Delayed implementation      | 1.4          | 0.8            | -7.9         | 4.9          | <0.001 | 1216 |
|                             | (-16.3 – 19.2) | (0.1 – 1.5)    | (-106.1 – 53.0) | (-7.5 – 2.3) | 1252 | 89.6 |
| Weekly intervals            | -7.7         | 0.1            | 29.9         | -4.0         | 0.004 | 2744 |
|                             | (-58.3 – 42.9) | (-1.3 – 1.5)   | (5.8 – 54.0) | (-6.8 – 1.3) | 2788 | 73.3 |

**OTHER MEDICATIONS FOR NICOTINE DEPENDENCE (VĂRENCICLE/BUPROPION)**

| Step                        | Announcement | Implementation |
|-----------------------------|--------------|----------------|
|                             | Coefficient  | Coefficient    | Coefficient  | Coefficient  | AIC/  | Adj. |
|                             | (95% CI)     | (95% CI)       | (95% CI)     | (95% CI)     | BIC   | R²   |
| Closed prisons              | -4.9         | 0.1            | 48.2         | -9.1         | 0.001 | 1244 |
|                             | (-46.3 – 35.6) | (-2.1 – 2.3)   | (20.0 – 75.6) | (-14.4 – 3.8) | 1280 | 87.5 |
| All prisons                 | -7.3         | 0.9            | 49.8         | -7.4         | 0.001 | 1288 |
|                             | (-66.6 – 52.0) | (-2.6 – 2.6)   | (4.9 – 53.3) | (-11.6 – 3.2) | 1321 | 82.7 |
| Adjusted for crowding       | -4.1         | 0.0            | 49.8         | -9.6         | 0.002 | 1242 |
|                             | (-46.9 – 38.6) | (-2.7 – 2.0)   | (12.8 – 86.8) | (-15.8 – 3.5) | 1281 | 87.8 |
| Delayed implementation      | 1.4          | 0.8            | -7.9         | 4.9          | <0.001 | 1216 |
|                             | (-16.3 – 19.2) | (0.1 – 1.5)    | (-106.1 – 53.0) | (-7.5 – 2.3) | 1252 | 89.6 |
| Weekly intervals            | -7.7         | 0.1            | 29.9         | -4.0         | 0.004 | 2744 |
|                             | (-58.3 – 42.9) | (-1.3 – 1.5)   | (5.8 – 54.0) | (-6.8 – 1.3) | 2788 | 73.3 |
| Step | Announced | | | Step | Implementation | | | Model fit |
|------|-----------|----------------|----------------|------|----------------|----------------|----------------|----------------|
|      | Coefficient (95% CI) | p value | Slope Coefficient (95% CI) | p value |  Coefficient (95% CI) | p value | Coefficient (95% CI) | p value | AIC/ BIC | Adj. R² |
| **SMOKING-RELATED ILLNESS: ALL** | | | | | | | | | | |
| Closed prisons | -76.4 (-458.9 – 306.1) | 0.695 | -23.9 (-41.4 – -6.4) | 0.007 | -646.2 (-1,110.9 – -181.4) | 0.006 | 16.5 (-13.6 – 46.7) | 0.282 | 2271 | 54.6 |
| All prisons | -112.5 (-479.7 – 254.8) | 0.548 | -22.8 (-39.4 – -6.1) | 0.007 | -716.3 (-1,160.5 – -272.2) | 0.007 | 16.6 (-12.1 – 45.4) | 0.257 | 2270 | 54.8 |
| Adjusted for crowding | -70.2 (-466.0 – 325.6) | 0.728 | -24.7 (-43.6 – -5.8) | 0.011 | -657.6 (-1,130.6 – -184.6) | 0.006 | 16.2 (-14.5 – 47.0) | 0.300 | 2273 | 54.6 |
| Delayed implementation | -33.7 (-377.7 – 310.3) | 0.848 | -26.7 (-41.0 – -12.4) | <0.001 | -752.0 (-1,253.8 – -250.1) | 0.003 | 33.8 (0.2 – 67.3) | 0.049 | 2269 | 56.7 |
| Weekly intervals | -63.5 (-431.4 – 304.3) | 0.735 | -11.7 (-21.3 – -2.1) | 0.017 | -752.1 (-1,256.3 – -247.9) | 0.003 | 10.3 (-5.2 – 25.8) | 0.192 | 4472 | 35.8 |
| **SMOKING-RELATED ILLNESS: RESPIRATORY** | | | | | | | | | | |
| Closed prisons | 65.7 (-130.4 – 261.9) | 0.511 | -4.3 (-13.0 – 4.4) | 0.330 | -485.9 (-746.7 – 225.1) | <0.001 | 11.0 (-24.7 – 2.7) | 0.114 | 2131 | 61.4 |
| All prisons | 80.6 (-172.8 – 334.1) | 0.533 | -3.7 (-14.7 – 7.2) | 0.506 | -552.9 (-819.4 – 286.4) | <0.001 | 10.0 (-26.0 – 6.0) | 0.221 | 2177 | 54.8 |
| Adjusted for crowding | 77.1 (-130.5 – 284.6) | 0.467 | -5.8 (-15.5 – 3.9) | 0.243 | -510.6 (-772.2 – 249.0) | <0.001 | 11.9 (-25.9 – 2.2) | 0.098 | 2174 | 61.6 |
| Delayed implementation | 128.0 (-73.4 – 329.3) | 0.213 | -7.3 (-15.3 – 0.6) | 0.071 | -631.6 (-925.9 – 337.3) | <0.001 | 3.6 (-13.9 – 21.2) | 0.687 | 2168 | 60.4 |
| Weekly intervals | 109.7 (-129.6 – 348.8) | 0.369 | -2.4 (-8.3 – 3.6) | 0.436 | -556.0 (-859.1 – 252.9) | <0.001 | -4.0 (-12.7 – 4.8) | 0.375 | 4512 | 43.7 |
| **SMOKING-RELATED ILLNESS: CARDIOVASCULAR** | | | | | | | | | | |
| Closed prisons | -105.6 (-191.4 – 19.8) | 0.016 | 1.3 (-1.9 – 4.5) | 0.418 | -49.6 (-170.8 – 71.6) | 0.422 | -2.2 (-9.4 – 5.1) | 0.561 | 1769 | 12.1 |
| All prisons | -105.0 (-185.7 – 24.4) | 0.011 | 1.0 (-2.1 – 4.1) | 0.529 | -41.1 (-152.8 – 70.6) | 0.471 | -2.1 (-8.9 – 4.7) | 0.546 | 1790 | 12.1 |
| Adjusted for crowding | -107.7 (-196.6 – 18.7) | 0.018 | 1.7 (-1.8 – 5.1) | 0.342 | -44.9 (-164.6 – 74.9) | 0.463 | -2.0 (-9.2 – 5.1) | 0.581 | 1771 | 12.3 |
| Delayed implementation | -92.3 (-178.5 – 6.2) | 0.036 | 0.3 (-2.8 – 3.3) | 0.865 | -6.0 (-132.8 – 120.8) | 0.926 | -2.5 (-10.9 – 5.8) | 0.551 | 1792 | 11.3 |
| Weekly intervals | -99.5 (-173.7 – 25.2) | 0.009 | 0.6 (-1.0 – 2.2) | 0.438 | -45.1 (-134.1 – 43.9) | 0.321 | -1.0 (-3.9 – 1.8) | 0.473 | 3686 | 14.7 |
## SMOKING-RELATED ILLNESS: GASTROINTESTINAL

| Step                                      | Announcement | Implementation |
|-------------------------------------------|--------------|----------------|
|                                           | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | AIC/BIC | Adj. R² |
| Closed prisons                            | -73.9        | 0.529        | -21.0                | <0.001   | -137.3                | 0.468   | 30.2    | 0.006   | 2122    | 2143   | 27.6    |
|                                           | (-303.7 – 156.0) |          | (-32.3 – -9.7)      |          | (-507.6 – 233.1)      |          |         |         |         |        |         |
| All prisons                               | -106.5       | 0.352        | -20.5                | <0.001   | -164.1                | 0.370   | 30.1    | 0.006   | 2116    | 2137   | 28.9    |
|                                           | (-330.6 – 117.7) |        | (-31.1 – -9.8)      |          | (-523.1 – 194.9)      |          |         |         |         |        |         |
| Adjusted for crowding                     | -66.9        | 0.563        | -22.1                | <0.001   | -153.0                | 0.420   | 29.7    | 0.008   | 2124    | 2148   | 27.8    |
|                                           | (-294.0 – 160.1) |       | (-34.0 – -10.3)     |          | (-524.8 – 218.8)      |          |         |         |         |        |         |
| Delayed implementation                    | -76.7        | 0.491        | -20.8                | <0.001   | -113.9                | 0.624   | 33.7    | 0.018   | 2122    | 2143   | 28.0    |
|                                           | (-294.8 – 141.4) |       | (-30.1 – -11.4)     |          | (-568.8 – 341.0)      |          |         |         |         |        |         |
| Weekly intervals                          | -82.7        | 0.500        | -10.3                | 0.001    | -138.8                | 0.423   | 15.5    | 0.004   | 4447    | 4473   | 15.6    |
|                                           | (-323.3 – 157.8) |       | (-16.5 – -4.2)      |          | (-478.3 – 200.8)      |          |         |         |         |        |         |

## SMOKING-RELATED ILLNESS: SENSORY

| Step                                      | Announcement | Implementation |
|-------------------------------------------|--------------|----------------|
|                                           | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | AIC/BIC | Adj. R² |
| Closed prisons                            | 1.4          | 0.032        | -0.1                 | 0.002   | -0.8                 | 0.541   | 0.2     | 0.017   | 670     | 697    | 37.8    |
|                                           | (0.1 – 2.6)  |            | (-0.2 – 0.0)        |          | (-3.5 – 1.8)        |          |         |         |         |        |         |
| All prisons                               | 1.2          | 0.053        | -0.1                 | 0.004   | -0.9                 | 0.503   | 0.2     | 0.034   | 666     | 693    | 37.8    |
|                                           | (0.0 – 2.4)  |            | (-0.2 – 0.0)        |          | (-3.7 – 1.8)        |          |         |         |         |        |         |
| Adjusted for crowding                     | 1.4          | 0.023        | -0.1                 | 0.001   | -1.0                 | 0.483   | 0.2     | 0.020   | 672     | 702    | 38.1    |
|                                           | (0.2 – 2.7)  |            | (-0.2 – 0.0)        |          | (-3.8 – 1.8)        |          |         |         |         |        |         |
| Delayed implementation                    | 1.4          | 0.025        | -0.1                 | 0.001   | -0.2                 | 0.892   | 0.2     | 0.016   | 670     | 697    | 37.8    |
|                                           | (0.2 – 2.7)  |            | (-0.2 – 0.0)        |          | (-2.7 – 2.4)        |          |         |         |         |        |         |
| Weekly intervals                          | 1.3          | 0.038        | 0.0                  | 0.001   | -1.0                 | 0.399   | 0.1     | 0.011   | 1513    | 1547   | 37.5    |
|                                           | (0.1 – 2.6)  |            | (-0.1 – 0.0)        |          | (-3.4 – 1.3)        |          |         |         |         |        |         |

## MENTAL HEALTH: ALL ANTI-DEPRESSANTS

| Step                                      | Announcement | Implementation |
|-------------------------------------------|--------------|----------------|
|                                           | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value | AIC/BIC | Adj. R² |
| Closed prisons                            | -119.7       | 0.119        | -2.9                 | 0.502   | 151.7                | 0.263   | 0.5     | 0.940   | 2145    | 2172   | 81.2    |
|                                           | (-270.2 – 30.7) |        | (-11.5 – 5.6)       |          | (-114.2 – 417.5)     |          |         |         |         |        |         |
| All prisons                               | -113.1       | 0.131        | -3.8                 | 0.374   | 150.6                | 0.272   | 1.0     | 0.882   | 2137    | 2164   | 82.0    |
|                                           | (-259.9 – 33.7) |        | (-12.2 – 4.6)       |          | (-118.1 – 419.3)     |          |         |         |         |        |         |
| Adjusted for crowding                     | -100.1       | 0.254        | -4.0                 | 0.396   | 114.8                | 0.418   | 0.7     | 0.912   | 2146    | 2176   | 81.2    |
|                                           | (-272.3 – 72.0) |       | (-13.3 – 5.3)       |          | (-163.1 – 392.6)     |          |         |         |         |        |         |
| Delayed implementation                    | -133.8       | 0.043        | -2.0                 | 0.577   | 158.2                | 0.269   | -2.2    | 0.809   | 2146    | 2172   | 81.1    |
|                                           | (-263.6 – -4.0) |      | (-9.0 – 5.0)        |          | (-122.3 – 438.6)     |          |         |         |         |        |         |
| Weekly intervals                          | -107.1       | 0.186        | -1.7                 | 0.440   | 198.0                | 0.125   | -0.5    | 0.861   | 4490    | 4523   | 70.9    |
|                                           | (-265.8 – 51.6) |       | (-6.2 – 2.7)        |          | (-55.1 – 451.2)      |          |         |         |         |        |         |
| Step                                      | Announcement | Implementation |
|-------------------------------------------|--------------|----------------|
|                                           | Step         | Step           |
|                                           | Coefficient  | Coefficient    | Coefficient  | Coefficient  | Coefficient  |
|                                           | (95% CI)     | (95% CI)       | (95% CI)     | (95% CI)     | (95% CI)     |
|                                           | P value      | P value        | P value      | P value      | P value      |
| MENTAL HEALTH: SSRI ONLY                 |              |                |              |              |              |
| Closed prisons                           | -121.3       | -3.1           | 18.2         | 0.611        | 3.2          |
| (-171.9 – -70.7)                         | <0.001       | 0.020          | (-52.0 – 88.4) | 0.054        | 0.068        |
| All prisons                              | -118.7       | -3.3           | 18.8         | 0.592        | 3.0          |
| (-167.4 – -70.0)                         | <0.001       | 0.011          | (-50.0 – 87.6) | 0.068        | 0.059        |
| Adjusted for crowding                     | -116.3       | -3.4           | 9.3          | 0.804        | 3.2          |
| (172.2 – -60.5)                          | <0.001       | 0.018          | (-64.0 – 82.6) | 0.059        | 0.278        |
| Delayed implementation                    | -123.0       | -3.0           | 32.8         | 0.379        | 2.5          |
| (-166.1 – -79.9)                         | <0.001       | 0.003          | (-40.3 – 105.9) | 0.278        | 0.123        |
| Weekly intervals                          | -118.3       | -1.6           | 29.9         | 0.440        | 1.5          |
| (-174.5 – -62.2)                         | <0.001       | 0.028          | (-46.0 – 105.7) | 0.080        | 0.080        |
| MENTAL HEALTH: HYPNOTICS/ANXIOLYTICS [post-protocol analysis] |              |                |              |              |              |
| Closed prisons                           | 8.8          | -0.3           | -17.1        | 0.782        | 1.4          |
| (-79.0 – 96.7)                           | 0.844        | 0.877          | (-138.0 – 103.8) | 0.708        | 1.862        |
| All prisons                              | 8.1          | -0.4           | -16.7        | 0.780        | 1.4          |
| (-77.3 – 93.4)                           | 0.853        | 0.842          | (133.5 – 100.2) | 0.700        | 1.854        |
| Adjusted for crowding                     | 25.4         | -1.8           | -45.8        | 0.454        | 1.2          |
| (-66.8 – 117.5)                          | 0.590        | 0.413          | (-165.7 – 74.0) | 0.750        | 1.862        |
| Delayed implementation                    | -3.1         | 0.6            | -87.4        | 0.250        | 3.9          |
| (-90.7 – 84.6)                           | 0.945        | 0.729          | (-236.5 – 61.6) | 0.411        | 1.861        |
| Weekly intervals                          | 3.5          | 0.1            | -36.9        | 0.469        | 0.7          |
| (-71.2 – 78.3)                           | 0.926        | 0.911          | (-136.7 – 62.9) | 0.606        | 1.865        |
| CONTROL: ANTI-EPILEPTICS                  |              |                |              |              |              |
| Closed prisons                           | -19.0        | 2.1            | -70.9        | 0.223        | -0.7         |
| (-94.8 – 56.8)                           | 0.623        | 0.230          | (-184.8 – 43.1) | 0.820        | 0.715        |
| All prisons                              | -30.0        | 2.4            | -80.0        | 0.166        | -1.1         |
| (-104.1 – 44.2)                          | 0.428        | 0.166          | (-193.2 – 33.1) | 0.715        | 0.826        |
| Adjusted for crowding                     | -12.0        | 1.7            | -78.0        | 0.175        | -0.7         |
| (-87.9 – 63.9)                           | 0.757        | 0.333          | (-190.6 – 34.6) | 0.826        | 0.175        |
| Delayed implementation                    | -15.9        | 1.9            | -101.8       | 0.063        | 1.7          |
| (-92.1 – 60.3)                           | 0.683        | 0.275          | (-209.4 – 5.7) | 0.610        | 0.175        |
| Weekly intervals                          | 13.9         | 0.5            | -32.1        | 0.473        | -0.4         |
| (-66.7 – 94.5)                           | 0.735        | 0.591          | (-119.6 – 55.5) | 0.767        | 0.372        |

| Step                                      | Announcement | Implementation |
|-------------------------------------------|--------------|----------------|
|                                           | AIC/ BIC     | Adj. R²        |
| MENTAL HEALTH: SSRI ONLY                 |              |                |
| Closed prisons                           | 1729         | 70.4           |
| All prisons                              | 1753         | 71.7           |
| Adjusted for crowding                     | 1722         | 70.6           |
| Delayed implementation                    | 1746         | 70.5           |
| Weekly intervals                          | 1730         | 59.2           |
| MENTAL HEALTH: HYPNOTICS/ANXIOLYTICS [post-protocol analysis] |              |                |
| Closed prisons                           | 1862         | 5.8            |
| All prisons                              | 1886         | 6.3            |
| Adjusted for crowding                     | 1854         | 7.3            |
| Delayed implementation                    | 1878         | 6.9            |
| Weekly intervals                          | 1862         | 6.5            |
| CONTROL: ANTI-EPILEPTICS                  |              |                |
| Closed prisons                           | 1752         | 45.7           |
| All prisons                              | 1762         | 49.5           |
| Adjusted for crowding                     | 1746         | 45.9           |
| Delayed implementation                    | 1776         | 45.9           |
| Weekly intervals                          | 1751         | 28.9           |
### Section S7. Relative effect estimates, expressed as percentage change in fortnightly rate of dispensing per 1000 persons in custody: primary analysis (closed prisons)

| Category                                                   | Announcement | Implementation |
|------------------------------------------------------------|--------------|----------------|
|                                                           | Step         | Slope          |
|                                                           | Percentage change (95% CI) | Percentage change (95% CI) |
| All nicotine dependence                                   | 19.7 (-150.6 – 111.2) | 1.2 (-2.7 – 5.1) |
| Nicotine replacement therapy                              | -26.2 (-157.4 – 105.0) | 1.5 (-2.4 – 5.3) |
| Other medications for nicotine dependence (varenicline/bupropion) | -5.8 (-55.1 – 43.5) | 0.1 (-2.5 – 2.7) |
| All smoking-related illness                               | -1.0 (-5.8 – 3.9) | -0.3 (-0.5 – 0.1) |
| Smoking-related illness: respiratory                      | 1.4 (-2.8 – 5.7) | -0.1 (-0.3 – 0.1) |
| Smoking-related illness: cardiovascular                   | -43.9 (-79.5 – -8.2) | 0.5 (-0.8 – 1.9) |
| Smoking-related illness: gastrointestinal                 | -2.4 (-10.0 – 5.1) | -0.7 (-1.1 – 0.3) |
| Smoking-related illness: sensory                          | 23.3 (1.7 – 43.3) | -1.7 (-3.3 – 0.0) |
| Mental health: all anti-depressants                       | -2.8 (-6.4 – 0.7) | -0.1 (-0.3 – 0.1) |
| Mental health: SSRI only                                  | -12.1 (-17.1 – -7.0) | -0.3 (-0.6 – 0.0) |
| Mental health: hypnotics/anxiolytics                      | 1.0 (-8.8 – 10.8) | 0.0 (-0.4 – 0.4) |
| Control: anti-epileptics                                 | -2.4 (-11.8 – 7.1) | 0.3 (-0.2 – 0.7) |
Section S8. Results of indicator saturation analyses

Indicator saturation analyses allow the identification of multiple step or slope changes by testing for breaks at every point in the time series and removing all but the significant breaks (at the level specified), using general-to-specific model selection 17. We built indicator saturation models using the gets package in R version 3.6.3, using time series properties identified from the ACF/PACF plots and final set of Stata models. Models for all outcomes were specified to test for step or slope changes, using a p value set at p<0.0001. The table below shows the date and magnitude of step and slope changes identified as significant under these parameters. Note that the inclusion of slope variables influences the validity of standard errors so confidence intervals should be interpreted with caution.

| Date          | Coefficient (95% CI) | P value | Date          | Coefficient (95% CI) | P value | Ljung Box | Adj. R² |
|---------------|----------------------|---------|---------------|----------------------|---------|-----------|---------|
| 02-12-2018    | -6034.2 (-6981.7 - -5086.7) | <0.001  | 11-08-2019    | -1357.0 (-1788.9 - -925.2) | <0.001  |           | 0.926  |
| 13-01-2019    | 6091.4 (4933.5 - 7249.4)   | <0.001  | 06-10-2019    | 1438.2 (934.6 - 1941.8)   | <0.001  |           | 0.336  |
| 24-02-2019    | 4975.3 (3849.0 - 6101.6)   | <0.001  | -   | -   | -   |           | 94.4   |
| 24-03-2019    | 6081.1 (5033.4 - 7128.8)   | <0.001  | -   | -   | -   |           |         |
| 07-04-2019    | -2456.4 (-3528.7 - -1384.1) | <0.001  | -   | -   | -   |           |         |
| 21-04-2019    | 6095.1 (4989.8 - 7200.5)   | <0.001  | -   | -   | -   |           |         |
| 11-08-2019    | 3564.8 (2358.9 - 4770.7)   | <0.001  | -   | -   | -   |           |         |
| 02-12-2018    | -4800.4 (-5651.4 - -3949.4) | <0.001  | 16-12-2018    | 1174.0 (1026.8 - 1321.2) | <0.001  |           | 0.746  |
| 13-01-2019    | 6362.8 (5198.7 - 7527.0)   | <0.001  | 30-12-2018    | -3305.8 (-3701.1 - -2910.5) | <0.001  |           | 0.505  |
| 24-02-2019    | 4963.8 (3819.3 - 6108.3)   | <0.001  | 19-05-2019    | 2467.5 (2068.5 - 2866.5)   | <0.001  |           | 93.9   |
| 24-03-2019    | 5936.0 (4879.4 - 6992.6)   | <0.001  | -   | -   | -   |           |         |
| 07-04-2019    | -2761.5 (-3833.8 - -1689.2) | <0.001  | -   | -   | -   |           |         |

Nicotine replacement therapy

| Date          | Coefficient (95% CI) | P value | Date          | Coefficient (95% CI) | P value | Ljung Box | Adj. R² |
|---------------|----------------------|---------|---------------|----------------------|---------|-----------|---------|
| 02-12-2018    | -4800.4 (-5651.4 - -3949.4) | <0.001  | 16-12-2018    | 1174.0 (1026.8 - 1321.2) | <0.001  |           | 0.746  |
| 13-01-2019    | 6362.8 (5198.7 - 7527.0)   | <0.001  | 30-12-2018    | -3305.8 (-3701.1 - -2910.5) | <0.001  |           | 0.505  |
| 24-02-2019    | 4963.8 (3819.3 - 6108.3)   | <0.001  | 19-05-2019    | 2467.5 (2068.5 - 2866.5)   | <0.001  |           | 93.9   |
| 24-03-2019    | 5936.0 (4879.4 - 6992.6)   | <0.001  | -   | -   | -   |           |         |
| 07-04-2019    | -2761.5 (-3833.8 - -1689.2) | <0.001  | -   | -   | -   |           |         |
| Date         | Value 1          | Range 1          | p-value 1 | Value 2          | Range 2          | p-value 2 | <br>Value 3 | Range 3          | p-value 3 |
|--------------|------------------|------------------|-----------|------------------|------------------|-----------|------------|------------------|-----------|
| 21-04-2019   | 6019.7           | (4976.3 – 7207.2)| <0.001    | -                | -                | -         |            |                  |           |
| 11-08-2019   | -2107.1          | (-2847.2 – -1367.1) | <0.001    | -                | -                | -         |            |                  |           |
| Other medications for nicotine dependence (varenicline/bupropion) | | | | | | | | 0.755 | 0.832 | 87.4 |
| 16-12-2018   | -94.3            | (-124.9 – -63.6)  | <0.001    | -                | -                | -         |            |                  |           |
| 30-12-2018   | 83.8             | (51.4 – 116.1)    | <0.001    | -                | -                | -         |            |                  |           |
| Smoking-related illness - all | | | | | | | | 0.502 | 0.168 | 65.3 |
| 21-12-2014   | -8022.4          | (-9909.7 – -6135.2) | <0.001    | 06-12-2015       | 791.3           | (340.7 – 1241.9) | <0.001    | 04-01-2015       | 7975.4   | (6055.5 – 9895.4) | <0.001    | 06-12-2015 | -2913.1    | (-4706.9 – -1119.3) | 0.002 | - | - | - | 16-12-2018 | -681.0   | (-1023.8 – -338.2) | <0.001 | - | - | - | Respiratory | -921.3   | (-1101.5 – -741.1) | <0.001 | - | - | - | Cardiovascular | - | - | - | - | - |
| Gastrointestinal | - | - | - | 24-05-2015 | 19.9 | (5.2 – 13.6) | <0.001 | 03-07-2016 | -24.7 | (-31.5 – -17.8) | <0.001 | 09-04-2017 | 9.4 | (5.2 - 13.6) | <0.001 | - | - | - | Sensory | -19.5 | (-23.9 – -15.1) | <0.001 | - | - | - | 27-08-2017 | 20-05-2018 | -3.1 | (-5.1 -- -1.1) | 0.003 | - | - | - | Mental health – all antidepressants | -1611.7 | (-2265.0 – -958.3) | <0.001 | 03-01-2016 | 1541.8 | (881.0 – 2202.6) | <0.001 | - | - | - | 20-12-2015 | 0.987 | 0.304 | 85.3 |
| Mental health - SSRI | 20-12-2015 | -298.9 | (-442.4 – -155.5) | <0.001 | - | - | - | 0.951 | 0.802 | 84.8 |
| Mental health - SSRI | 03-01-2016 | 318.8 | (177.3 – 460.2) | <0.001 | - | - | - |
|                         | 14-02-2016 | 08-10-2017 |
|-------------------------|------------|------------|
| Mental health –         | -          | -          |
| hypnotics/anxiolytics   | -          | -          |
|                         | -          | -          |
| Control – anti-epileptics| 62.4       | 69.3       |
|                         | (20.9 – 103.9) | (11.5 – 127.0) |
|                         | 0.004      | 0.020      |
|                         | -          | -          |
|                         | -          | -          |
|                         | -          | -          |
|                         | 0.532      | 0.850      |
|                         | 63.0       | 63.0       |