# Contraception and Covid-19 Restrictions in Scotland

## Introduction

In England, a recent article revealed changes in prescribing of contraception between 2019 and 2020 on account of the SARS-CoV-2 pandemic, and associated restrictions. I will examine if this is the case in Scotland too.

I have divided contraceptive prescriptions into three classes: long-acting reversible contraception (LARC), oral (OC), and emergency contraception (EC).

| LARC | Oral | Emergency |
|---|---|---|
| Injections | Combined | Levonorgestorel (1.5mg) |
| Intrauterine systems | Progesterone-only | Ulipristal acetate |
| Intrauterine devices | | |
| Implants | | |

- Oral contraceptives require the least health care resources to prescribe.
- Emergency contraception is frequently dispensed from community pharmacies.
- LARC requires skilled healthcare professionals to dispense it, as their insertion or injection requires additional training. This is often in GP surgeries of GUM clinics.

I imagine that due to Covid-19 restrictions, there will likely be a decrease in prescribing of LARC, and emergency contraception due to social restrictions. I also imagine that an associated uptick in the numbers of oral contraceptive prescriptions will be dispensed due to these drugs being prescribed in place of LARC.

**Hypothesis 1: in Scotland, as in England, contraceptives prescribed in the community changed due to Covid-19 lockdowns.**

**Hypothesis 2: in Scotland, contraceptives prescribed in the community during Covid-19 lockdowns differed by deprivation.**

I will examine these hypotheses using data from the *Prescribing in the Community Dataset* from NHS Scotland, geospatial data, and the Scottish Index of Multiple Deprivation.

## Data Import and Wrangle

```
#Here, we load the required packages for this analysis
if(!require(pacman))
  install.packages("pacman")
pacman::p_load("gtExtras", "tidyverse", "lubridate", "readxl", "ggplot2", "sf", "gt", "here",
 ↪  "colorspace", "patchwork", "scales", "ggspatial", "mapview", "glue")
```

### Setup custom functions

```r
#This function will perform an analysis pipeline on the data in a DRY way.
Wrangle <- function(DatasetToWrangle) {
  DatasetToWrangle <- DatasetToWrangle %>%
    filter(GPPractice %in% GPPractices$GPPractice) %>%
    mutate(HealthBoard = case_when(is.na(HBT) ~ HBT2014, !is.na(HBT) ~ HBT))
  DatasetToWrangle <- full_join(DatasetToWrangle, HealthBoards, by = "HealthBoard") %>%
    full_join(., GPPractices, by = "GPPractice") %>%
    full_join(., SIMD, by = "DataZone") %>%
    mutate(HealthBoard = as.factor(HB), SIMDOverallRank = as.factor(SIMD2020v2_Vigintile), GPPractice =
     ↪  as.factor(GPPractice), DataZone = as.factor(DataZone),
 HealthBoardName = as.factor(HealthBoardName), HealthBoardCode = as.factor(HealthBoardCode),
  ↪  PaidDateMonth = ymd(PaidDateMonth)) %>%
    select(c(HealthBoard, SIMDOverallRank, GPPractice, DataZone, HealthBoardName,HealthBoardCode,
     ↪  PaidDateMonth, PaidQuantity)) %>%
    drop_na()}
#Highlights periods of lockdown in plots
AnnotateLockdowns <- function(Plot) {
  annotate(geom = "rect",
    xmin = c(dmy("23/03/2020"), dmy("26/12/2020"), dmy("26/12/2021")),
    xmax = c(dmy("19/07/2020"), dmy("16/04/2021"), dmy("21/03/2022")),
    ymin = c(-Inf, -Inf, -Inf),
    ymax = c(Inf, Inf, Inf),
  fill = "yellow", alpha = 0.25)}
#Custom ggplot theme
ThemeCustom <- function(Plot) {
  theme_minimal(base_size=10) %+replace%
    theme(legend.position = "none",
      plot.title = element_text(hjust = 0.5, face = "bold", size = 12, margin = margin(0, 0, 5, 0)),
      panel.grid.minor.y=element_blank(),
      axis.title.y = element_text(angle = 90, margin = margin(r = 5)),
      axis.text.y = element_text(angle = 45),
      strip.text = element_text(face = "italic"),
      axis.title.y.right = element_text(angle = 90),
      axis.text.x.bottom = element_text(angle = 45, margin = margin(t = 10)),
    plot.margin = margin(5, 5, 5, 5))}
#Returns data for the table by calculating the mean number of prescriptions dispensed per month, taking
 ↪  into account the varying numbers of Health Boards reporting over the years
TableWrangle <- function(Dataset) {
  Dataset %>%
    filter(between(PaidDateMonth, as_date("2015-10-01"), as_date("2020-07-19"))) %>%
    select(PaidDateMonth, PaidQuantity, HealthBoardCode) %>%
    group_by(PaidDateMonth) %>%
    summarise(SumPaidQuantity = sum(PaidQuantity), NumberHealthBoards = n_distinct(HealthBoardCode),
      NumberMonths = n_distinct(PaidDateMonth), .groups = 'drop') %>%
    mutate(TimePeriod = case_when(PaidDateMonth < as_date("2020-03-22") ~ "Pre-Covid",
        between(PaidDateMonth, as_date("2020-03-23"), as_date("2020-07-19")) ~ "Lockdown 1")) %>%
    mutate(TimePeriodDates = case_when(TimePeriod == "Pre-Covid" ~ "01/10/2015 - 22/03/2020",
     ↪  TimePeriod == "Lockdown 1" ~ "23/03/2020 - 19/07/2020"),
      MeanPrescriptionsDispensedPerHealthBoardPerMonth =
        ((SumPaidQuantity / NumberHealthBoards) / NumberMonths)) %>%
    group_by(TimePeriod) %>%
    mutate(MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod =
     ↪  (mean(MeanPrescriptionsDispensedPerHealthBoardPerMonth))) %>%
    select(TimePeriod, TimePeriodDates, MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod) %>%
    distinct(TimePeriod, TimePeriodDates, MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod) %>%
    tibble() %>%
    mutate(PercentageChange = round(((
      MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod /
 ↪  lag(MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod) *
```

```
        100) - 100), 1), PercentageChangePretty = case_when(
PercentageChange > 0 ~ paste0("+", PercentageChange, "%", " ↑"), PercentageChange < 0 ~
 ↪  paste0(PercentageChange, "%", " ↓")))}
#Calculates the percentage change in prescriptions dispensed between time periods
PercentageChange <- function(DatasetToZoom) {
  DatasetToZoom %>%
  group_by(PaidDateMonth, HealthBoardName, HealthBoard, HealthBoardCode) %>%
  summarise(SumPaidQuantity = sum(PaidQuantity), .groups = 'drop') %>%
  mutate(PercentageChange = round(((SumPaidQuantity / lag(SumPaidQuantity)) - 1), 1))}
#Calculates the mean number of prescriptions dispensed in a given time period
MeanPrescriptionsDispensed <- function(Dataset, DateFrom, DateTo) {Dataset %>%
  filter(between(PaidDateMonth, as_date(DateFrom), as_date(DateTo))) %>%
  group_by(HealthBoardName, HealthBoard, HealthBoardCode, Type) %>%
  summarise(SumPaidQuantity = sum(SumPaidQuantity),
  NumberMonths = n_distinct(PaidDateMonth)) %>%
  mutate(MeanPrescriptionsDispensed = (SumPaidQuantity/NumberMonths)) %>%
  select(c(HealthBoardName:Type, MeanPrescriptionsDispensed))}
#Extracts changes in contraception prescriptions in a given month and given SIMD vigintile and joins
 ↪  this with geospatial data for plotting
SIMDRankSpatialData <- function(SIMDRank, Month) {
  SIMDHealthBoards %>%
    filter(SIMD2020v2_Vigintile == SIMDRank) %>%
    group_by(HealthBoardCode) %>%
    summarise(SumDZ = n_distinct(DataZone), .groups = "drop") %>%
    left_join(HealthBoardsSPDF, .) %>%
    left_join(., PercentageChangeAllContraception %>%
                filter(PaidDateMonth == Month)) %>%
    drop_na() %>%
    mutate(PerHB = PercentageChange/SumDZ, HBNorm = (PerHB-mean(PerHB))/sd(PerHB), PerHBBin =
     ↪  cut(HBNorm, breaks = -2:4))}
#Creates plots using the function above
MapTypeChangesPlot <- function(SIMDRank, Month, Palette) {
ggplot(data = SIMDRankSpatialData(SIMDRank, Month)) +
  geom_sf(aes(fill = PerHBBin)) +
  scale_fill_brewer(palette = Palette, name = "z-Score", labels = c(" -2  -  -1 ", " -1  -  ", "  -  +1 ",
   ↪  " +1  -  +2 ", " +2  -  +3 ", " +3  -  +4 ")) +
  theme_void() +
  facet_wrap( ~ Type, nrow = 1) & theme(legend.position = "bottom")}
```

## Prescriptions in the Community Data

```
#Imports a CSV file of all the URLS of the Scottish Prescription data and imports each one as a data
 ↪  frame before joining them all
URLList <-
 ↪  read_csv("https://raw.githubusercontent.com/s1906007/expert-octo-pancake/main/Data/URLList.csv")
 ↪  %>%
  mutate(YearMonths = ym(YearMonths), Month = month(YearMonths), Year = year(YearMonths))
URLList <- URLList %>%
  mutate(MonthYear = paste0(Year, Month))
for (row in 1:nrow(URLList)) {
  assign(paste0("DF", URLList$MonthYear[row]), read_csv(URLList$URLs[row]))
  row = row + 1}
DFList <- mget(ls(pattern = "DF20"))
CompletePrescriptionDataset <- bind_rows(DFList)
```

## Other Datasets

We'll also import three more datasets: Health Board names and codes, GP Practice data and codes, and the Scottish Index of Multiple Deprivation data from 2020 as well as some geospatial data used for plotting later.

```
#Import Health Boards and assigns each a three letter code
HealthBoards <-
 ↪  read_csv(glue("https://www.opendata.nhs.scot/dataset/9f942fdb-e59e-44f5-b534-d6e17229cc7b/",
 ↪  "resource/652ff726-e676-4a20-abda-435b98dd7bdc/download/hb14_hb19.csv")) %>% select(c(HB, HBName))
 ↪  %>%
  mutate(HealthBoardName = HBName, HealthBoard = HB, HealthBoardCode = c("AaA", "Bor", "DaG", "Fif",
   ↪  "Fif", "FoV", "Gra", "GGC", "GGC", "Hig","Lan", "Lan", "Lot", "Ork", "She", "Tay", "Tay", "WIs"))
#Import the Scottish Index of Multiple Deprivation data
download.file(glue("https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2020/01/",
 ↪  "scottish-index-of-multiple-deprivation-2020-data-zone-look-up-file/documents/",
 ↪  "scottish-index-of-multiple-deprivation-data-zone-look-up/scottish-index-of-multiple-",
 ↪  "deprivation-data-zone-look-up/govscot%3Adocument/SIMD%2B2020v2%2B-%2Bdatazone%2Blookup.xlsx"),
 ↪  (here("Data", "SIMD.xlsx")))
SIMD <- read_excel((here("Data", "SIMD.xlsx")), sheet = 3) %>% mutate(DataZone = DZ, HealthBoard =
 ↪  HBcode)
#Import GP Practices and adds on a row for community pharmacies
CommunityPharmacies <- list(99998, "S92000003", "S92000003")
GPPractices <-
 ↪  read_csv(glue("https://www.opendata.nhs.scot/dataset/f23655c3-6e23-4103-a511-a80d998adb90/resource/",
 ↪  "1a15cb34-fcf9-4d3f-ad63-1ba3e675fbe2/download/practice_contactdetails_oct2022-open-data.csv")) %>%
  mutate(GPPractice = PracticeCode, HealthBoard = HB) %>%
  select(c(GPPractice, HealthBoard, DataZone)) %>% rbind(., CommunityPharmacies)
#Download the Geospatial data and joins it with the Health Boards data
download.file("https://maps.gov.scot/ATOM/shapefiles/SG_NHS_HealthBoards_2019.zip", here("Data",
 ↪  "GeoData", "HealthBoards", "HealthBoards.zip"))
unzip(here("Data", "GeoData", "HealthBoards", "HealthBoards.zip"), exdir = here("Data", "GeoData",
 ↪  "HealthBoards"))
HealthBoardsSPDF <- sf::st_read(dsn = here("Data", "GeoData", "HealthBoards"), layer =
 ↪  "SG_NHS_HealthBoards_2019", quiet = TRUE)
HealthBoardsSPDF <- HealthBoardsSPDF %>%
  mutate(HealthBoard = HBCode) %>%
  left_join(., HealthBoards, by = "HealthBoard")
```

## Contraception Data

Here we filter the `CompletePrescriptions` dataset for different types of contraception and join them together into a tibble for each of our three types of contraception - LARC, Oral, and Emergency.

```
#Extracting contraception data into seperate tibbles from all prescriptions data
Injection <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemCode, "0703022M"))
IUS <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemCode, "0703023"))
IUD <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemCode, "21040"))
Implant <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemDescription, "NEXPLANON"))
LARCList <- list(IUD, IUS, Implant, Injection)
LARC <- map_df(LARCList, Wrangle)
EmergencyContraception <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemCode, "0703050")) %>% Wrangle(.)
OralContraception <- CompletePrescriptionDataset %>%
  filter(str_detect(BNFItemCode, "0703010")) %>%
```

```
  filter(str_detect(BNFItemDescription, "TAB")) %>%
  rbind(., CompletePrescriptionDataset %>% filter(str_detect(BNFItemCode, "0703021"))) %>% Wrangle(.)
```

### Mapping Data

Here, we wrangle the geospatial data loaded earlier and calculate the percentage change in contraception prescriptions dispensed before and during the first lockdown.

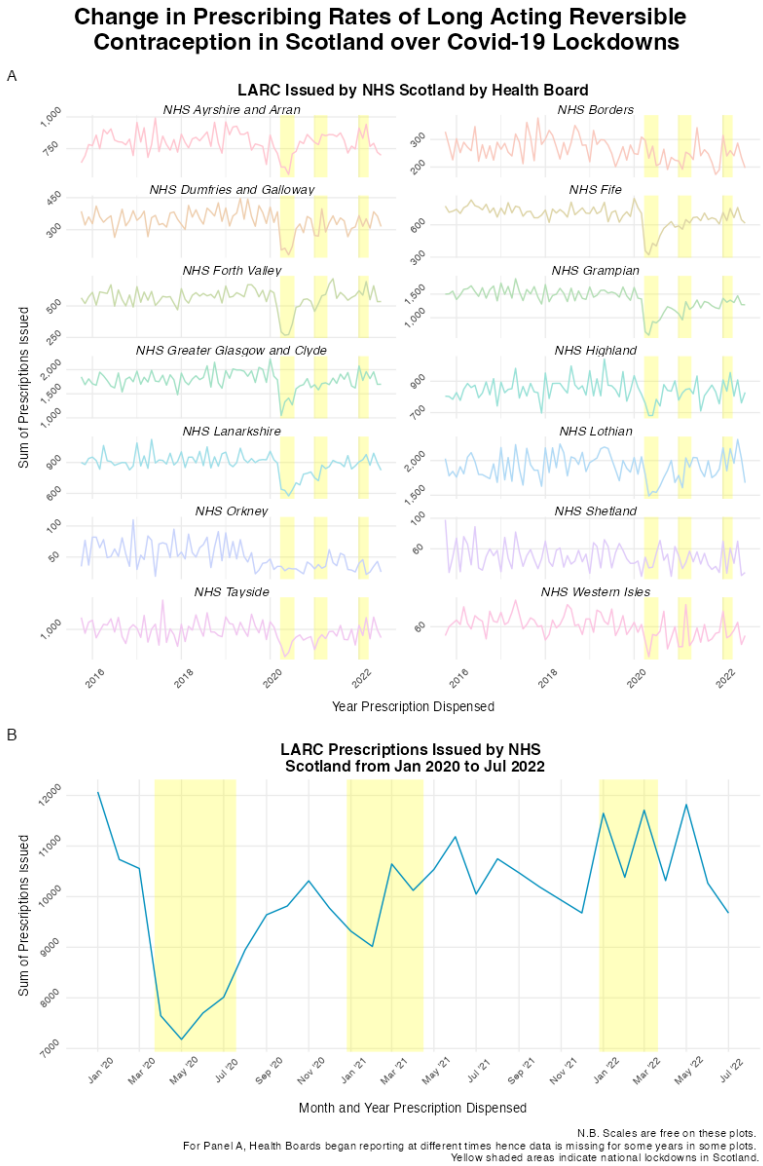
```
#Wrangling geospatial data and healthboards into one tibble
SIMDHealthBoards <- left_join(SIMD, HealthBoards)
PercentageChangeAllContraception <- bind_rows((PercentageChange(LARC) %>%  mutate(Type = "LARC")),
 ↪  (PercentageChange(EmergencyContraception) %>% mutate(Type = "EC")),
 ↪  (PercentageChange(OralContraception) %>% mutate(Type = "OC")) %>% mutate(Type = as.factor(Type)))
PreLockdownMeanDispensed <- MeanPrescriptionsDispensed(PercentageChangeAllContraception, "2015-10-01",
 ↪  "2020-03-20")
Lockdown1MeanDispensed <- MeanPrescriptionsDispensed(PercentageChangeAllContraception, "2020-03-21",
 ↪  "2020-07-19")
DifferenceMeanDispensed <- left_join(PreLockdownMeanDispensed, Lockdown1MeanDispensed, by =
 ↪  c("HealthBoardName", "HealthBoard", "HealthBoardCode", "Type")) %>%
  mutate(Difference =
   ↪  round(((MeanPrescriptionsDispensed.y-MeanPrescriptionsDispensed.x)/MeanPrescriptionsDispensed.x)
   ↪  * 100, 0))
HealthBoardDeprivationRanks <- SIMDHealthBoards %>%
  group_by(HealthBoardCode, HB) %>%
  summarise(SumSIMD = sum(SIMD2020v2_Vigintile), numDZ = sum(n_distinct(DZ)), Rank =
   ↪  as.factor(round(SumSIMD/numDZ, 0)), .groups = "drop") %>%  mutate(Rank = fct_relevel(Rank,
   ↪  c("13", "12", "11", "10", "9")))
HealthBoardsDifferenceSPDF <- left_join(HealthBoardsSPDF, DifferenceMeanDispensed)
HealthBoardsDeprivationSPDF <- left_join(HealthBoardsSPDF, HealthBoardDeprivationRanks)
```

## Results

### How did LARC prescriptions change over time?

```
#Plot LARC Prescription Trends per Month per Health Board (Panel A)
LARCPlot <- LARC %>%
  group_by(PaidDateMonth, HealthBoardName) %>%
  summarise(SumPaidQuantity = sum(PaidQuantity), .groups = 'drop') %>%
  ggplot(aes(x = PaidDateMonth, y = SumPaidQuantity)) +
  AnnotateLockdowns() +
  geom_line(mapping = aes(colour = HealthBoardName)) +
  scale_y_continuous(labels= scales::comma, n.breaks = 3) +
  scale_x_date() +
  scale_color_discrete_qualitative(palette = "Pastel1") +
  facet_wrap(~ HealthBoardName, ncol = 2, scales = "free_y", shrink = TRUE) +
  labs(title = "LARC Issued by NHS Scotland by Health Board",
       x = "Year Prescription Dispensed", y = "Sum of Prescriptions Issued") +
  ThemeCustom()
#Plot LARC Prescription Trends per Month for all of Scotland but zoomed in on 2020 to 2022 (Panel B)
LARCPlotScotlandZoomed <- LARC %>%
  group_by(PaidDateMonth) %>%
  filter(as_date(PaidDateMonth) >= as_date("2020-01-01")) %>%
  summarise(SumPaidQuantity = sum(PaidQuantity), .groups = 'drop') %>%
  mutate(PercentageChange = round(((SumPaidQuantity / lag(SumPaidQuantity)) - 1), 1)) %>%
  ggplot(aes(x = PaidDateMonth, y = SumPaidQuantity)) +
```

```
  AnnotateLockdowns() +
  geom_line(colour = "#0391BF") +
  scale_x_date(date_breaks="2 months",  date_labels = "%b '%y", minor_breaks = NULL) +
  labs(title = "LARC Prescriptions Issued by NHS \n Scotland from Jan 2020 to Jul 2022", x = "Month and
   ↪  Year Prescription Dispensed", y = "Sum of Prescriptions Issued") +
  ThemeCustom()
#Now to put Panels A & B  together to make one plot
LARCPlotsPatchwork <- LARCPlot + LARCPlotScotlandZoomed + plot_layout(ncol = 1, heights = c(2,1)) +
  plot_annotation(
    caption = "N.B. Scales are free on these plots. \n For Panel A, Health Boards began reporting at
     ↪  different times hence data is missing for some years in some plots. \n Yellow shaded areas
     ↪  indicate national lockdowns in Scotland.",
 tag_levels = 'A',
    title = "Change in Prescribing Rates of Long Acting Reversible \n Contraception in Scotland over
     ↪  Covid-19 Lockdowns",
 theme = theme(plot.title = element_text(hjust = 0.5, face = "bold", size = 18), plot.margin =
  ↪  margin(5, 5, 5, 5)))
```




In Panel A, we can see that throughout the period before the first lockdown in March 2020, there was a variable but fairly consistent rate of LARC prescriptions within each Health Board. From March 2020 we see an immediate steep decline in LARC being dispensed, supporting the first hypothesis that restricted access to sexual health service providers due to Covid-19 restrictions was common to both Scotland and England.

In Panel B, we see a 'zoomed-in' view of of the 2020-22, and can see the same trend reflected nationally, and in each lockdown. However, the decrease in LARC prescribing is never as severe as, and is quicker to recover than in March 2020.

## How did contraceptive prescribing change during Lockdown 1?

```
#Create tibble of wrangled data
TableData <- bind_rows(TableWrangle(LARC), TableWrangle(OralContraception),
 ↪  TableWrangle(EmergencyContraception))
#Create a gt table showing % change before lockdown vs during
TableData %>% gt() %>%
  #Table styling
cols_hide(PercentageChange) %>% tab_header(title = "Mean Quantities of Contraception Dispensed by NHS
 ↪  Scotland", subtitle = "Between October 2015 and July 2020") %>%
  cols_label(TimePeriod = "Time Period", TimePeriodDates = "Dates", PercentageChangePretty =
   ↪  "Percentage Change", MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod = "Mean Prescriptions
   ↪  Dispensed Per Month Per Health Board") %>%
  tab_row_group(label = "LARC", rows = 1:2) %>% tab_row_group(label = "Oral Contraception", rows = 3:4)
   ↪  %>% tab_row_group(label = "Emergency Contraception", rows = 5:6) %>% cols_move(TimePeriodDates,
   ↪  after = TimePeriod) %>%
  fmt_integer(MeanPrescriptionsDispensedPerHealthBoardPerTimePeriod) %>% tab_style(style =
   ↪  list(cell_text(color = "red")), locations = cells_body(columns = PercentageChangePretty, rows =
   ↪  PercentageChange < 0)) %>% tab_style(style = list(cell_text(color = "chartreuse4")), locations =
   ↪  cells_body(columns = PercentageChangePretty, rows = PercentageChange > 0)) %>% gt_theme_538() %>%
   ↪  tab_options(heading.align = "center", row_group.font.weight = "bold", row_group.background.color
   ↪  = "turquoise", row.striping.background_color = "grey90") %>% opt_row_striping() %>%
   ↪  cols_align(align = "center", columns = c(TimePeriodDates:PercentageChangePretty))
```

Here, we are exploring whether this effect is replicated across all three categories of contraception in March 2020.

**Mean Quantities of Contraception Dispensed by NHS Scotland**

Between October 2015 and July 2020

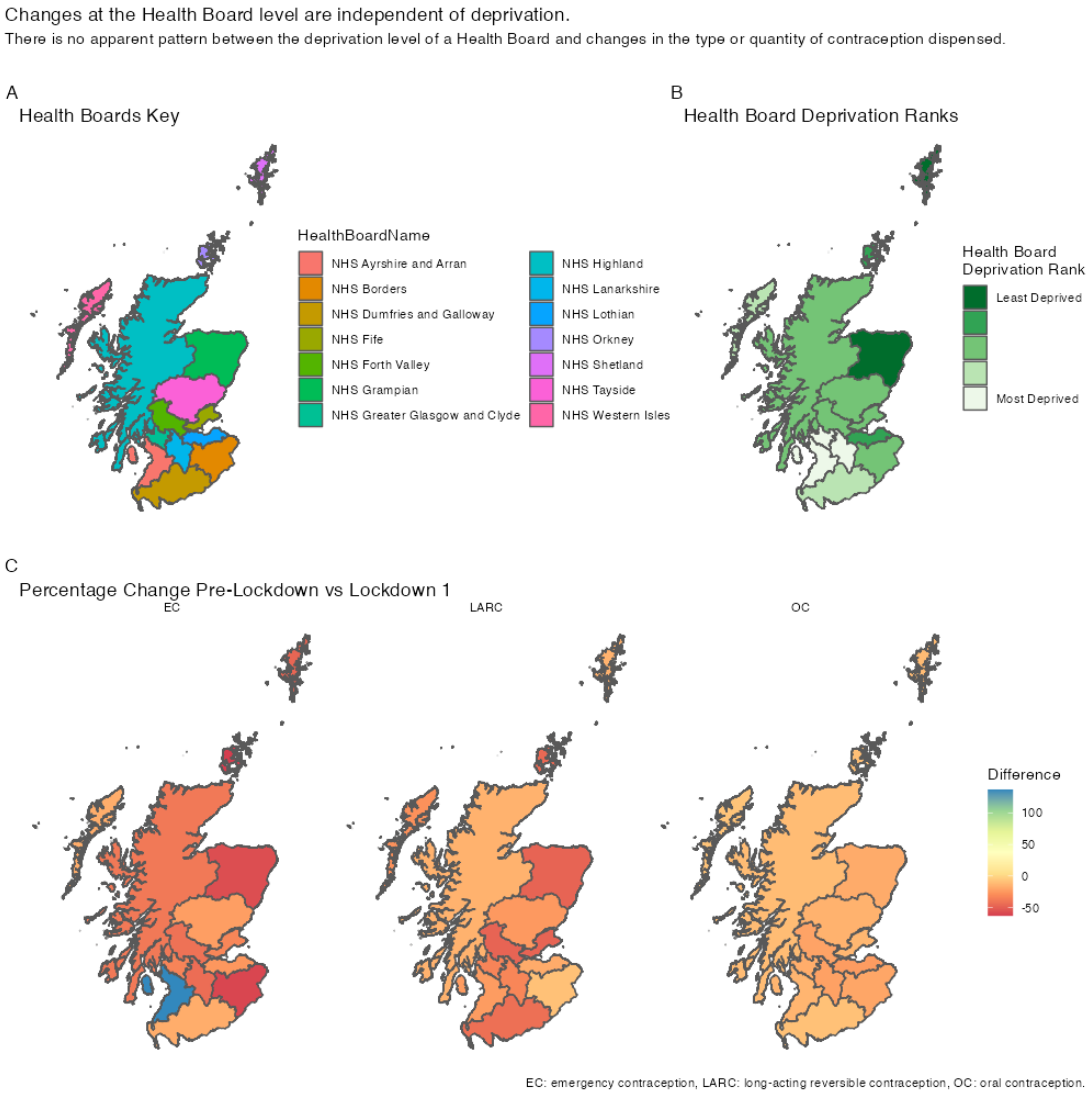
| TIME PERIOD | DATES | MEAN PRESCRIPTIONS DISPENSED PER MONTH PER HEALTH BOARD | PERCENTAGE CHANGE |
|---|---|---|---|
| **EMERGENCY CONTRACEPTION** | | | |
| Pre-Covid | 01/10/2015 - 22/03/2020 | 44 | NA |
| Lockdown 1 | 23/03/2020 - 19/07/2020 | 28 | -36.3% ↓ |
| **ORAL CONTRACEPTION** | | | |
| Pre-Covid | 01/10/2015 - 22/03/2020 | 520,294 | NA |
| Lockdown 1 | 23/03/2020 - 19/07/2020 | 403,641 | -22.4% ↓ |
| **LARC** | | | |
| Pre-Covid | 01/10/2015 - 22/03/2020 | 965 | NA |
| Lockdown 1 | 23/03/2020 - 19/07/2020 | 636 | -34.1% ↓ |

Evidently, it is. There is a very similar decrease ($\sim 35\%$) in prescriptions for LARC - due to reasons mentioned previously - and emergency contraception, presumably due to social restrictions leading to less sexual activity overall, reducing the number of emergency contraception prescriptions dispensed. Oral contraception also decreased, but interestingly only by around 20%. I propose this decrease is lessened as women seeking LARC were likely being prescribed oral contraceptives instead.

### Are there differences in contraceptive prescribing between Health Boards?

```
#Create key for map plot of health boards (Panel A)
MapKeyPlot <- ggplot(data = HealthBoardsSPDF) +
  geom_sf(aes(fill = HealthBoardName)) +
  theme_void() + ggtitle("Health Boards Key") + guides(fill=guide_legend(ncol = 2))
#Create map plot of health board deprivation ranks (Panel B)
MapDeprivationRanksPlot <- ggplot(data = HealthBoardsDeprivationSPDF) +
  geom_sf(aes(fill = Rank)) +
  scale_fill_brewer(palette = "Greens", direction = -1, labels = c("Least Deprived", " ", " ", " ",
   ↪  "Most Deprived"), "Health Board \nDeprivation Rank") +
  theme_void() + ggtitle("Health Board Deprivation Ranks")
#Create map plot of % change in prescriptions dispensed before vs during lockdown by health board
 ↪  (Panel C)
MapPrescriptionChangePlot <- ggplot(data = HealthBoardsDifferenceSPDF) +
  geom_sf(aes(fill = Difference)) +
  scale_fill_distiller(palette = "Spectral", direction = 1) +
  theme_void() +
  facet_wrap(~ Type, nrow = 1) + ggtitle("Percentage Change Pre-Lockdown vs Lockdown 1")
#Put panels together into patchwork plot
MapPlotsPatchworkA <-  (MapKeyPlot + MapDeprivationRanksPlot) / MapPrescriptionChangePlot +
 ↪  plot_annotation(tag_levels = 'A', title = "Changes at the Health Board level are independent of
 ↪  deprivation.", subtitle = "There is no apparent pattern between the deprivation level of a Health
 ↪  Board and changes in the type or quantity of contraception dispensed.", caption = "EC: emergency
 ↪  contraception, LARC: long-acting reversible contraception, OC: oral contraception.")
```

Here, we are looking at deprivation on the Health Board level (key in Panel A). Health Boards have been ranked into one of 5 categories of mean deprivation based upon the SIMD vigintiles the data zones they contain fall into (Panel B).

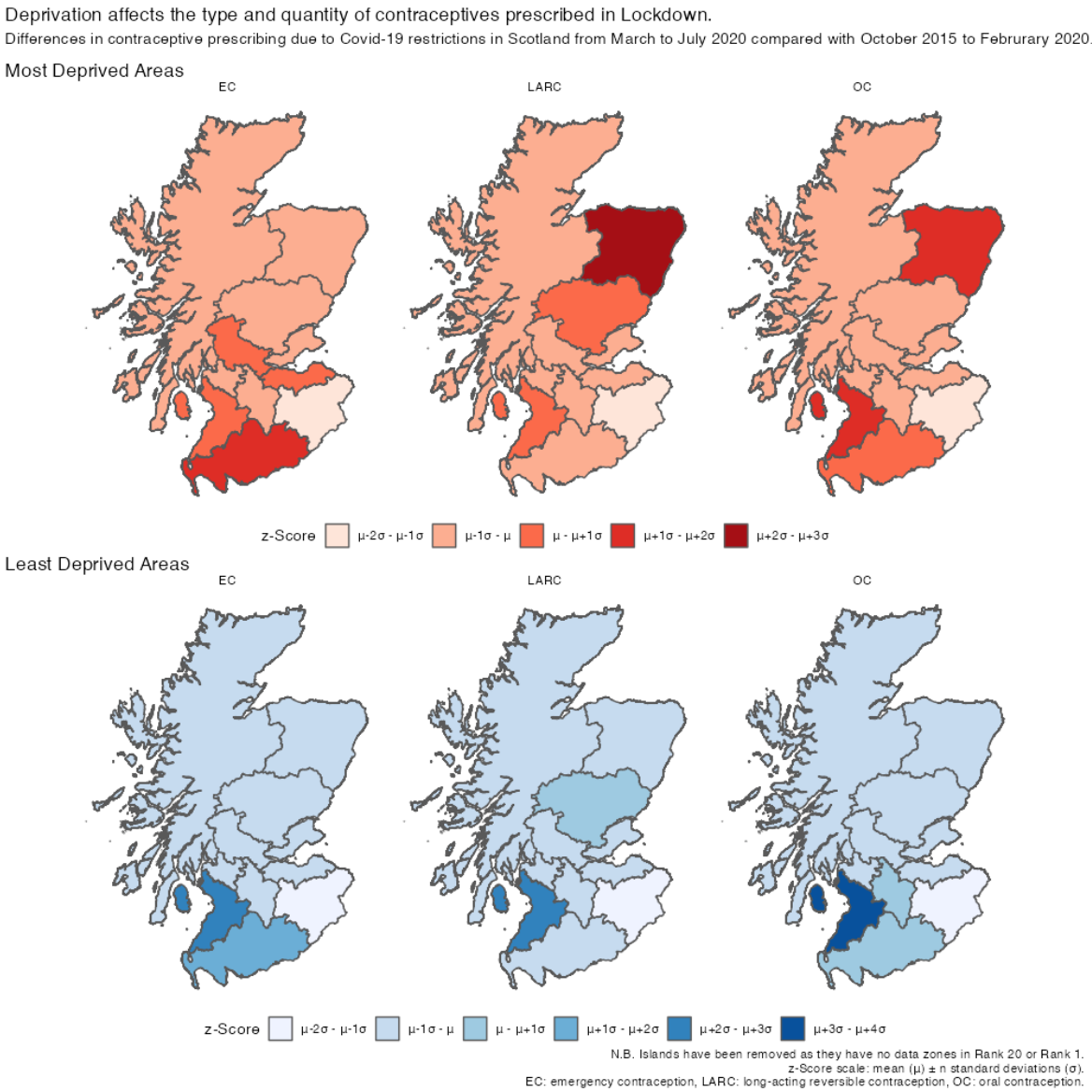



Looking at the percentage change of different types of contraception dispensed (Panel C), there does not appear to be a clear pattern linking the changes in either the type or quantity of contraceptives being prescribed and the overall deprivation of the Health Board (Panel B). It is clear that bar emergency contraception prescriptions in NHS Ayrshire and Arran, there is a large overall decrease in contraception prescriptions across Scotland in the lockdown of March 2020.

## How does deprivation affect contraceptive prescribing?

```
#Create map plot of SIMD vigintile 1 z-score changes in contraception prescribing before vs during
 ↪  Lockdown 1
MapTypeChangesPlot1 <- MapTypeChangesPlot(1, "2020-03-01", "Reds") + ggtitle("Most Deprived Areas")
#Create map plot of SIMD vigintile 20 z-score changes in contraception prescribing before vs during
 ↪  Lockdown 1
MapTypeChangesPlot20 <- MapTypeChangesPlot(20, "2020-03-01", "Blues") + ggtitle("Least Deprived Areas")
 ↪  + guides(fill = guide_legend(nrow = 1))
#Put panels together into patchwork plot
MapPlotsPatchworkB <- MapTypeChangesPlot1 / MapTypeChangesPlot20 + plot_annotation(caption = "N.B.
 ↪  Islands have been removed as they have no data zones in Rank 20 or Rank 1.\nz-Score scale: mean ( )
 ↪  ± n standard deviations ( ).\nEC: emergency contraception, LARC: long-acting reversible
 ↪  contraception, OC: oral contraception.", title =  "Deprivation affects the type and quantity of
 ↪  contraceptives prescribed in Lockdown.", subtitle = "Differences in contraceptive prescribing due
 ↪  to Covid-19 restrictions in Scotland from March to July 2020 compared with October 2015 to
 ↪  Februrary 2020.")
```

Here, we look at whether differences exist between the most deprived (SIMD vigintile 1), or least deprived (SIMD vigintile 20), broken down by Health Board area. These results have been normalised, and are presented as z-scores.




Some Health Boards, such as NHS Borders seem to have little difference between different forms of contraception, and between the areas of highest and lowest deprivation. However, others such as NHS Grampian, display much larger differences in both areas.

## Summary

In summary, we have seen:

- A large decrease in prescribing of LARC in Scotland across all Health Boards.
- A large decrease in the prescriptions dispensed for Oral and Emergency contraception and LARC.
- There appears to be little pattern to this by Health Board, despite the overall differences in Deprivation between them.
- However, when the data are viewed more granularly at an individual Data Zone level, there does appear to be differences in prescribing within and between Health Boards.