QCI of Orofacial Clefts - analysis

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2024-03-24

Loading required packages

```
pacman::p_load(dplyr,
               ggplot2,
               knitr,
               tidyr,
               readstata13,
               here,
               gt)
```

Loading the dataset

```
main_data = read.dta13(here("data", "main_data.dta"))
iso3 = read.dta13(here("data", "ISO3.dta"))
```

Results

Global Quality of Care (QCI):

```
kable(main_data %>%
        select(location_name, year, sex_name, pca_score) %>%
        filter(location_name == "Global",
                     year == c(1990, 2019)) %>%
        mutate(across(4, round, 1)))
```

```
## Warning: There was 1 warning in `mutate()`.
## i In argument: `across(4, round, 1)`.
## Caused by warning:
## ! The `...` argument of `across()` is deprecated as of dplyr 1.1.0.
## Supply arguments directly to `.fns` through an anonymous function instead.
##
##   # Previously
##   across(a:b, mean, na.rm = TRUE)
##
##   # Now
##   across(a:b, \(x) mean(x, na.rm = TRUE))
```

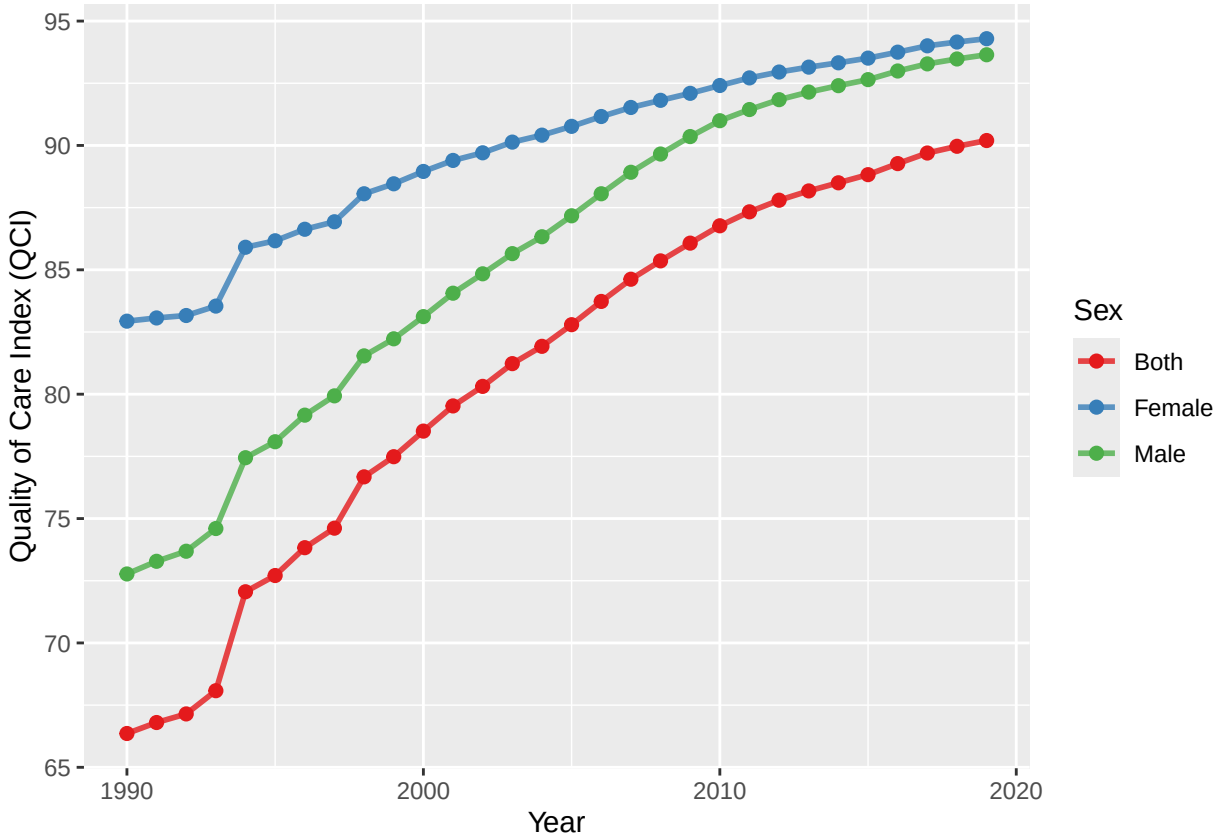
location_name	year	sex_name	pca_score
Global	1990	Both	66.4
Global	2019	Both	90.2

location_name	year	sex_name	pca_score
Global	1990	Female	82.9
Global	2019	Female	94.3
Global	1990	Male	72.8
Global	2019	Male	93.6

And its plot:

```
main_data %>%
        filter(location_name == "Global" & age_name == "Age-standardized") %>%
        ggplot(aes(year, pca_score, group = sex_name, color = sex_name)) +
        geom_line(size = 1, alpha = 0.8) +
        geom_point(size = 2) +
        scale_color_brewer(name = "Sex", palette = "Set1") +
        xlab("Year") +
        ylab("Quality of Care Index (QCI)")
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```




```
# dev.copy(tiff, "figures/Figure1.tiff", width = 20, height = 10, units = "cm", res = 300)
# dev.off()
```

Top countries:

```
kable(head(main_data %>%
        filter(year == 2019 & sex_name == "Both") %>%
        select(location_name, pca_score)  %>%
        arrange(desc(pca_score)) %>%
        mutate(across(2, round, 1))
    ))
```

location_name	pca_score
Norway	99.9
Ireland	99.4
France	99.4
Germany	99.3
Netherlands	99.3
Malta	99.3

Countries with the least QCI:

```
kable(tail(main_data %>%
        filter(year == 2019 & sex_name == "Both") %>%
        select(location_name, pca_score)  %>%
        arrange(desc(pca_score)) %>%
        mutate(across(2, round, 1))
    ))
```

	location_name	pca_score
217	Sierra Leone	75.3
218	Mali	74.4
219	Ethiopia	73.0
220	Burkina Faso	72.6
221	Niger	67.6
222	Somalia	59.1

Trend of change in QCI:

```
qci_trend = merge(main_data, iso3, by = "location_id") %>%
        select(location_name.y, year, sex_name, pca_score, type, iso3_countries) %>%
        filter(year %in% c(1990, 2019)) %>%
        distinct() %>%
        spread(year, pca_score) %>%
        mutate(year_ratio = `2019`/`1990`,
               compare = ifelse(`2019` > `1990`, "higher", "lower")) %>%
        mutate(year_ratio_cat = ifelse(year_ratio < 0.95, "lower",
                                       ifelse(year_ratio > 1.05, "higher", "equal")))
```

Countries in which the QCI has decreased:

```
kable(qci_trend %>%
        filter(sex_name == "Both" & type == "Country" & compare == "lower"))
```

location_name.y	sex_name	type	iso3_countries	1990	2019	year_ratio	compare	year_ratio_cat
Albania	Both	Country	ALB	98.07684	97.30689	0.9921495	lower	equal

location_name.y	sex_name	type	iso3_countries	1990	2019	year_ratio	compare	year_ratio_cat
Guam	Both	Country	GUM	96.41681	96.15187	0.9972522	lower	equal
New Zealand	Both	Country	NZL	99.06335	98.84734	0.9978196	lower	equal
Northern Mariana Islands	Both	Country	MNP	96.36154	96.27993	0.9991530	lower	equal
Norway	Both	Country	NOR	100.00000	99.90309	0.9990309	lower	equal
Singapore	Both	Country	SGP	99.23507	99.19500	0.9995961	lower	equal
Somalia	Both	Country	SOM	59.34079	59.05250	0.9951418	lower	equal
Zimbabwe	Both	Country	ZWE	85.88404	81.13136	0.9446616	lower	lower

```
qci_trend$type2 = factor(qci_trend$type, levels = c("Global", "WHO Regions", "World Bank Income Levels"

rows = (seq(nrow(filter(qci_trend, sex_name == "Both")))-1) %/% 37

qci_trend %>%
        dplyr::rename(Scale = type2, Location = location_name.y, QCI = `2019`) %>%
        filter(sex_name == "Both") %>%
        select(Scale, Location, QCI) %>%
        arrange(Scale, desc(QCI)) %>%
        mutate(QCI = round(QCI, 1)) %>%
        split(rows) %>%
        do.call(cbind, .) %>%
        #dplyr::rename(Scale = c(1, 4, 7, 10, 13), Location = c(2, 5, 8, 11, 14), QCI = c(3, 6, 9, 12,
        gt() %>%
          cols_label(
                  ends_with("QCI") ~ "QCI",
                  ends_with("Scale") ~ "Scale",
                  ends_with("Location") ~ "Location") %>%
        data_color(
                columns = c(`0.QCI`, `1.QCI`, `2.QCI`, `3.QCI`, `4.QCI`, `5.QCI`),
                method = "numeric",
                palette = c("red", "green"),
                domain = c(59.1, 99.9)) %>%
        data_color(
                columns = c(`0.Scale`, `1.Scale`, `2.Scale`, `3.Scale`, `4.Scale`, `5.Scale`),
                method = "factor",
                palette = "Set2"
        ) %>%
        gtsave("fig.png")


qci_trend %>%
        filter(sex_name == "Both") %>%
        select(location_name.y, type2, `2019`) %>%
        arrange(type2, desc(`2019`)) #%>%
```

```
##                     location_name.y                   type2     2019
## 1                            Global                  Global 90.19779
## 2                  European Region             WHO Regions 97.11111
## 3           Region of the Americas             WHO Regions 93.38609
## 4     Eastern Mediterranean Region             WHO Regions 92.02133
## 5           South-East Asia Region             WHO Regions 91.62646
## 6           Western Pacific Region             WHO Regions 91.29025
```

```
## 7                    African Region              WHO Regions 82.94872
## 8             World Bank High Income World Bank Income Levels 98.68135
## 9     World Bank Upper Middle Income World Bank Income Levels 92.88296
## 10    World Bank Lower Middle Income World Bank Income Levels 91.16962
## 11             World Bank Low Income World Bank Income Levels 80.33064
## 12                          High SDI                      SDI 98.51045
## 13                 High-middle SDI                      SDI 93.84630
## 14                      Middle SDI                      SDI 93.03736
## 15                   Low-middle SDI                      SDI 90.98462
## 16                          Low SDI                      SDI 84.72268
## 17                           Europe         4 World Regions 96.87435
## 18                          America         4 World Regions 93.38609
## 19                             Asia         4 World Regions 91.74093
## 20                           Africa         4 World Regions 84.87962
## 21                    North America       World Bank Regions 98.58294
## 22        Europe & Central Asia - WB       World Bank Regions 97.08795
## 23   Middle East & North Africa - WB       World Bank Regions 95.66187
## 24    Latin America & Caribbean - WB       World Bank Regions 92.37971
## 25                  South Asia - WB       World Bank Regions 91.82220
## 26         East Asia & Pacific - WB       World Bank Regions 90.30872
## 27          Sub-Saharan Africa - WB       World Bank Regions 82.38047
## 28                           Norway                   Country 99.90309
## 29                          Ireland                   Country 99.37874
## 30                           France                   Country 99.35528
## 31                          Germany                   Country 99.34695
## 32                      Netherlands                   Country 99.33693
## 33                            Malta                   Country 99.33319
## 34                            Spain                   Country 99.33005
## 35                         Portugal                   Country 99.32887
## 36                          Uruguay                   Country 99.31392
## 37                           Israel                   Country 99.29824
## 38                            Chile                   Country 99.28937
## 39                            Italy                   Country 99.27780
## 40                           Canada                   Country 99.26611
## 41                          Denmark                   Country 99.26362
## 42                          Austria                   Country 99.26275
## 43                          Iceland                   Country 99.25965
## 44                       Luxembourg                   Country 99.25373
## 45                        Australia                   Country 99.25336
## 46                          Belgium                   Country 99.24154
## 47                          Andorra                   Country 99.20224
## 48                           Sweden                   Country 99.19927
## 49                        Singapore                   Country 99.19500
## 50                   United Kingdom                   Country 99.15592
## 51                           Greece                   Country 99.15589
## 52                         Slovenia                   Country 99.12773
## 53                          Hungary                   Country 99.09388
## 54                        Argentina                   Country 99.08915
## 55                   Czech Republic                   Country 99.05188
## 56                          Croatia                   Country 99.03882
## 57                         Bulgaria                   Country 99.02584
## 58                        Lithuania                   Country 98.98025
## 59                           Brunei                   Country 98.97715
## 60                           Latvia                   Country 98.96509
```

```
## 61                    South Korea              Country 98.92488
## 62                         Panama              Country 98.89643
## 63                        Romania              Country 98.87222
## 64                    New Zealand              Country 98.84734
## 65                     Costa Rica              Country 98.83433
## 66                        Moldova              Country 98.82697
## 67                         Cyprus              Country 98.82615
## 68                          Japan              Country 98.69619
## 69                         Poland              Country 98.65582
## 70                         Serbia              Country 98.62487
## 71                  United States              Country 98.50286
## 72                    Puerto Rico              Country 98.41362
## 73                        Bermuda              Country 98.39093
## 74                     Montenegro              Country 98.35171
## 75                       Slovakia              Country 98.34010
## 76                    The Bahamas              Country 98.33795
## 77              Trinidad and Tobago              Country 98.32139
## 78                           Cuba              Country 98.31545
## 79                       Mongolia              Country 98.30684
## 80                     Uzbekistan              Country 98.29204
## 81          Bosnia and Herzegovina              Country 98.25654
## 82                        Belarus              Country 98.19649
## 83                        Finland              Country 98.14070
## 84                     Kazakhstan              Country 98.09598
## 85            Virgin Islands, U.S.              Country 98.09018
## 86                     Azerbaijan              Country 98.08890
## 87                        Georgia              Country 98.00003
## 88                        Grenada              Country 97.98003
## 89                       Colombia              Country 97.95313
## 90                     Kyrgyzstan              Country 97.92165
## 91                       Macedonia              Country 97.90547
## 92                     Saint Lucia              Country 97.90209
## 93                        Barbados              Country 97.88090
## 94                       Mauritius              Country 97.76093
## 95                       Greenland              Country 97.75769
## 96                    Turkmenistan              Country 97.64197
## 97                          Kuwait              Country 97.63782
## 98                         Jamaica              Country 97.57385
## 99               Dominican Republic              Country 97.41686
## 100                       Albania              Country 97.30689
## 101                         Qatar              Country 97.26739
## 102           United Arab Emirates              Country 97.13076
## 103                         Oman              Country 97.03222
## 104             Russian Federation              Country 97.03115
## 105                   Saudi Arabia              Country 96.96500
## 106                        Armenia              Country 96.88999
## 107                      Venezuela              Country 96.87538
## 108                          Syria              Country 96.64943
## 109                        Bahrain              Country 96.63952
## 110                 American Samoa              Country 96.58036
## 111                         Belize              Country 96.56692
## 112                          Egypt              Country 96.51796
## 113                        Lebanon              Country 96.46144
## 114                      Palestine              Country 96.37350
```

```
## 115                          Morocco               Country 96.32884
## 116         Northern Mariana Islands               Country 96.27993
## 117                            Libya               Country 96.21758
## 118                             Guam               Country 96.15187
## 119                            Tonga               Country 96.14428
## 120                       Tajikistan               Country 96.05603
## 121                          Algeria               Country 96.03327
## 122   Federated States of Micronesia               Country 95.92559
## 123                          Tunisia               Country 95.91315
## 124                             Iran               Country 95.89016
## 125                        Nicaragua               Country 95.85928
## 126                             Iraq               Country 95.85741
## 127                 Marshall Islands               Country 95.84155
## 128                             Fiji               Country 95.76432
## 129                      El Salvador               Country 95.76380
## 130                            Samoa               Country 95.76228
## 131 Saint Vincent and the Grenadines               Country 95.71629
## 132                          Vanuatu               Country 95.69464
## 133                          Estonia               Country 95.62623
## 134                  Solomon Islands               Country 95.61161
## 135                         Suriname               Country 95.34810
## 136                             Peru               Country 95.28146
## 137                           Guyana               Country 95.27401
## 138                Equatorial Guinea               Country 95.17824
## 139                         Kiribati               Country 95.00594
## 140                 Papua New Guinea               Country 94.89874
## 141                          Ecuador               Country 94.87318
## 142                            Gabon               Country 94.63134
## 143                          Ukraine               Country 94.48456
## 144              Antigua and Barbuda               Country 94.00753
## 145                        Sri Lanka               Country 93.54921
## 146                            Sudan               Country 93.53246
## 147                           Taiwan               Country 93.39876
## 148                           Bhutan               Country 92.85331
## 149                      Switzerland               Country 92.63828
## 150                         Botswana               Country 92.41345
## 151                         Honduras               Country 92.41233
## 152                         Thailand               Country 92.36613
## 153                            India               Country 92.31184
## 154                         Dominica               Country 92.11439
## 155                           Turkey               Country 92.04578
## 156                          Vietnam               Country 91.79236
## 157                            Congo               Country 91.59420
## 158                           Jordan               Country 91.55416
## 159                            Yemen               Country 91.53292
## 160                            China               Country 91.51940
## 161                       Seychelles               Country 91.48093
## 162                         Pakistan               Country 91.45064
## 163                       Cape Verde               Country 91.35201
## 164                       Bangladesh               Country 91.19101
## 165                          Namibia               Country 90.95483
## 166                            Ghana               Country 90.92936
## 167                            Haiti               Country 90.49722
## 168                         Maldives               Country 90.35650
```

```
## 169                          Malaysia               Country 90.21110
## 170                             Kenya               Country 89.84286
## 171             Sao Tome and Principe               Country 89.72025
## 172                            Mexico               Country 89.66448
## 173                             Nepal               Country 89.61565
## 174                            Uganda               Country 89.43847
## 175                        Mauritania               Country 89.36026
## 176                          Cameroon               Country 89.31353
## 177                            Angola               Country 89.16236
## 178                      Cote d'Ivoire               Country 89.07287
## 179                         Guatemala               Country 88.96181
## 180                            Rwanda               Country 88.56727
## 181                         Swaziland               Country 88.32760
## 182                            Zambia               Country 87.59568
## 183                           Bolivia               Country 87.29250
## 184                      South Africa               Country 87.23564
## 185                            Brazil               Country 87.10227
## 186                              Togo               Country 86.92593
## 187                       Afghanistan               Country 86.20671
## 188                           Comoros               Country 86.12101
## 189                          Djibouti               Country 85.88850
## 190                        Madagascar               Country 85.81094
## 191                           Liberia               Country 85.58770
## 192                            Malawi               Country 85.32916
## 193                         Indonesia               Country 85.21461
## 194                          Tanzania               Country 84.89089
## 195                           Lesotho               Country 84.80394
## 196                     Guinea-Bissau               Country 84.45294
## 197 Democratic Republic of the Congo               Country 83.65864
## 198                         The Gambia               Country 83.60179
## 199                           Nigeria               Country 82.95918
## 200                           Eritrea               Country 82.83619
## 201                          Paraguay               Country 82.71399
## 202                           Burundi               Country 82.69759
## 203                        Timor-Leste               Country 82.25290
## 204                           Senegal               Country 82.11638
## 205                          Cambodia               Country 81.64107
## 206                          Zimbabwe               Country 81.13136
## 207                        South Sudan               Country 80.80632
## 208                               Laos               Country 80.48815
## 209                       Philippines               Country 79.89827
## 210                             Benin               Country 79.76445
## 211                           Myanmar               Country 79.70363
## 212           Central African Republic               Country 77.02683
## 213                        North Korea               Country 76.79888
## 214                             Guinea               Country 76.79844
## 215                         Mozambique               Country 75.70680
## 216                               Chad               Country 75.49664
## 217                       Sierra Leone               Country 75.27606
## 218                               Mali               Country 74.44304
## 219                           Ethiopia               Country 73.00839
## 220                       Burkina Faso               Country 72.59247
## 221                              Niger               Country 67.62856
## 222                            Somalia               Country 59.05250
```

```
#         group_map(~ qci_table(.x)) %>%
#         data.frame(.) %>%
#         gt() %>%
#         fmt_markdown(columns = TRUE)
```

Computing gender disparity ratio (GDR):

```
gdr = merge(main_data, iso3, by = "location_name") %>%
        select(location_name, year, sex_name, pca_score, type, iso3_countries) %>%
        filter(sex_name %in% c("Male", "Female")) %>%
        distinct() %>%
        spread(sex_name, pca_score) %>%
        mutate(gdr = Female/Male) %>%
        mutate(gdr_cat = ifelse(gdr < 0.95, "low",
                                ifelse(gdr > 1.05, "high", "equal"))
               )
```

Comparing GDR categories in 1990 and 2019:

```
kable(merge(gdr %>%
              filter(year == 1990 & type == "Country") %>%
              group_by(gdr_cat) %>%
              summarise(n = n()),
      gdr %>%
              filter(year == 2019 & type == "Country") %>%
              group_by(gdr_cat) %>%
              summarise(n = n()),
      by = "gdr_cat") %>% setNames(c("gdr_cat", "1990", "2019")))
```

gdr_cat	1990	2019
equal	123	163
high	29	9
low	21	1

Comparing SDI world regions in terms of equal GDR:

```
kable(merge(gdr %>%
              filter(year == 1990 & type == "SDI") %>%
              group_by(location_name) %>%
              summarise(equal = ifelse(gdr_cat == "equal", TRUE, FALSE)),
      gdr %>%
              filter(year == 2019 & type == "SDI") %>%
              group_by(location_name) %>%
              summarise(equal = ifelse(gdr_cat == "equal", TRUE, FALSE)),
      by = "location_name") %>% setNames(c("location_name", "1990", "2019")))
```

location_name	1990	2019
High SDI	TRUE	TRUE
High-middle SDI	FALSE	TRUE
Low SDI	TRUE	TRUE
Low-middle SDI	FALSE	TRUE
Middle SDI	FALSE	TRUE

Comparing World Bank Income Levels in terms of equal GDR:

```
kable(merge(gdr %>%
              filter(year == 1990 & type == "World Bank Income Levels") %>%
              group_by(location_name) %>%
              summarise(equal = ifelse(gdr_cat == "equal", TRUE, FALSE)),
      gdr %>%
              filter(year == 2019 & type == "World Bank Income Levels") %>%
              group_by(location_name) %>%
              summarise(equal = ifelse(gdr_cat == "equal", TRUE, FALSE)),
      by = "location_name") %>% setNames(c("location_name", "1990", "2019")))
```

location_name	1990	2019
World Bank High Income	TRUE	TRUE
World Bank Low Income	TRUE	TRUE
World Bank Lower Middle Income	FALSE	TRUE
World Bank Upper Middle Income	FALSE	TRUE

Loading required packages

```
pacman::p_load(clipr,
               tidyr,
               dplyr,
               readstata13,
               data.table,
               FactoMineR,
               foreign,
               RColorBrewer,
               rgdal,
               ggplot2,
               readxl,
               randomcoloR,
               viridis,
               ineq,
               sp,
               LSD,
               reshape,
               ff,
               ffbase)
```

```
## Warning: package 'rgdal' is not available for this version of R
##
## A version of this package for your version of R might be available elsewhere,
## see the ideas at
## https://cran.r-project.org/doc/manuals/r-patched/R-admin.html#Installing-packages

## Warning in p_install(package, character.only = TRUE, ...):

## Warning in library(package, lib.loc = lib.loc, character.only = TRUE,
## logical.return = TRUE, : there is no package called 'rgdal'

## Warning: package 'ffbase' is not available for this version of R
##
## A version of this package for your version of R might be available elsewhere,
```

```
## see the ideas at
## https://cran.r-project.org/doc/manuals/r-patched/R-admin.html#Installing-packages
```

```
## Warning in p_install(package, character.only = TRUE, ...):
```

```
## Warning in library(package, lib.loc = lib.loc, character.only = TRUE,
## logical.return = TRUE, : there is no package called 'ffbase'
```

```
## Warning in pacman::p_load(clipr, tidyr, dplyr, readstata13, data.table, : Failed to install/load:
## rgdal, ffbase
```

The datasets are now created. Next, we w Map

```
#install.packages(c("cowplot", "googleway", "ggplot2", "ggrepel",
#                   "ggspatial", "libwgeom", "sf", "rnaturalearth", #"rnaturalearthdata", "rgeos", "hav

library("haven")
library("readstata13")
library("dplyr")
library("tidyr")
library("ggplot2")
theme_set(theme_bw())
library("sf")
```

```
## Linking to GEOS 3.11.0, GDAL 3.5.3, PROJ 9.1.0; sf_use_s2() is TRUE
```

```
library("rnaturalearth")
library("rnaturalearthdata")
```

```
##
## Attaching package: 'rnaturalearthdata'
```

```
## The following object is masked from 'package:rnaturalearth':
##
##     countries110
```

```
library("rgeos")
```

```
## rgeos version: 0.6-4, (SVN revision 699)
##  GEOS runtime version: 3.12.1-CAPI-1.18.1
##  Please note that rgeos will be retired during October 2023,
## plan transition to sf or terra functions using GEOS at your earliest convenience.
## See https://r-spatial.org/r/2023/05/15/evolution4.html for details.
##  GEOS using OverlayNG
##  Linking to sp version: 2.1-3
##  Polygon checking: TRUE
```

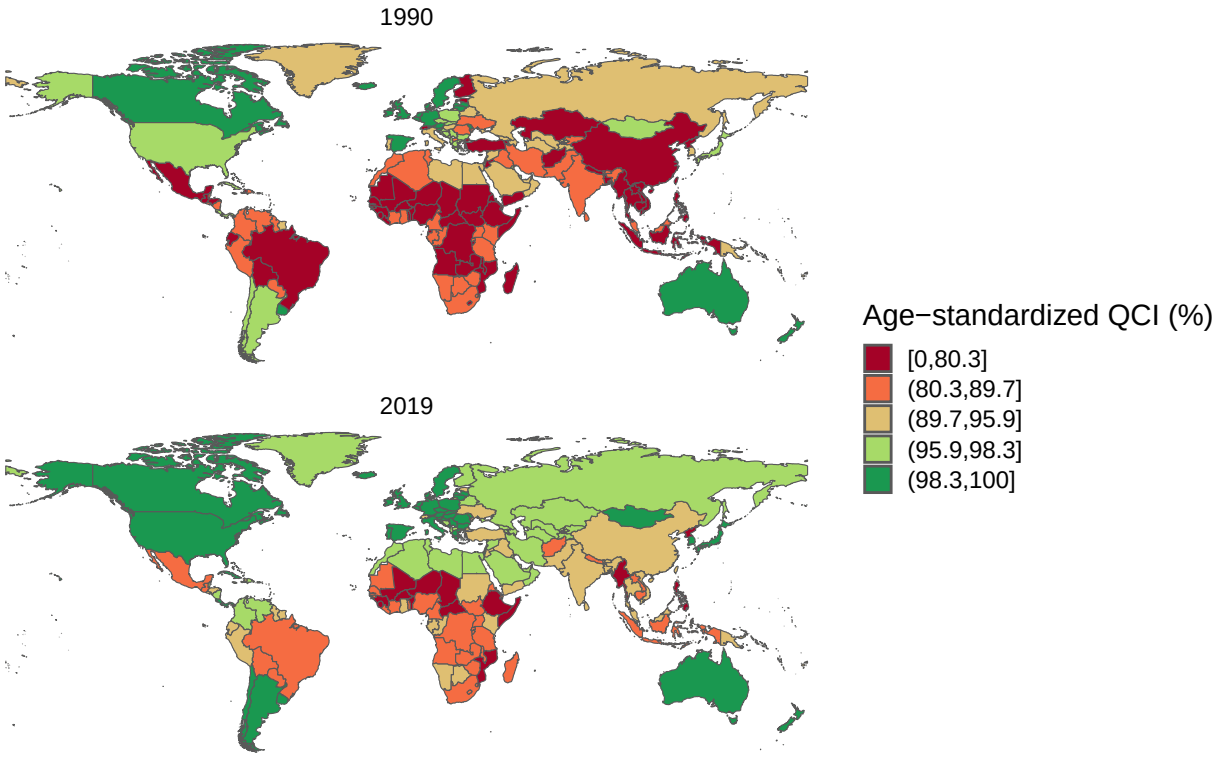
```
##
## Attaching package: 'rgeos'
```

```
## The following object is masked from 'package:bit':
##
##     symdiff
```

```
## The following object is masked from 'package:dplyr':
##
##     symdiff
```

```
map_data = merge(main_data, iso3, by = 'location_id')
map_data$Location = map_data$location_name
map_data$QCI = map_data$pca
```

```r
map_data$iso = map_data$iso3_countries
data2 = filter(map_data, year %in% c(1990, 2019), sex_name == 'Both', age_name == "Age-standardized", ty


quantile_values = quantile(data2$QCI, probs = seq(0, 1, 1/5))
data2$quantile = cut(data2$QCI, breaks = quantile_values, include.lowest = TRUE)

world = ne_countries(scale = "medium", returnclass = "sf")
world$iso = world$iso_a3
world = merge(world, data2, by = 'iso')


ggplot(data = world) +
        geom_sf(aes(fill = quantile)) +
        scale_fill_manual(values = c("#a40227", "#f56c42", "#dfbf72", "#a7da68", "#1a9850"), name = "Ag
        theme_void() +
        facet_wrap(~ year, ncol = 1) +
        theme(legend.key.size = unit(0.4, 'cm'))
```

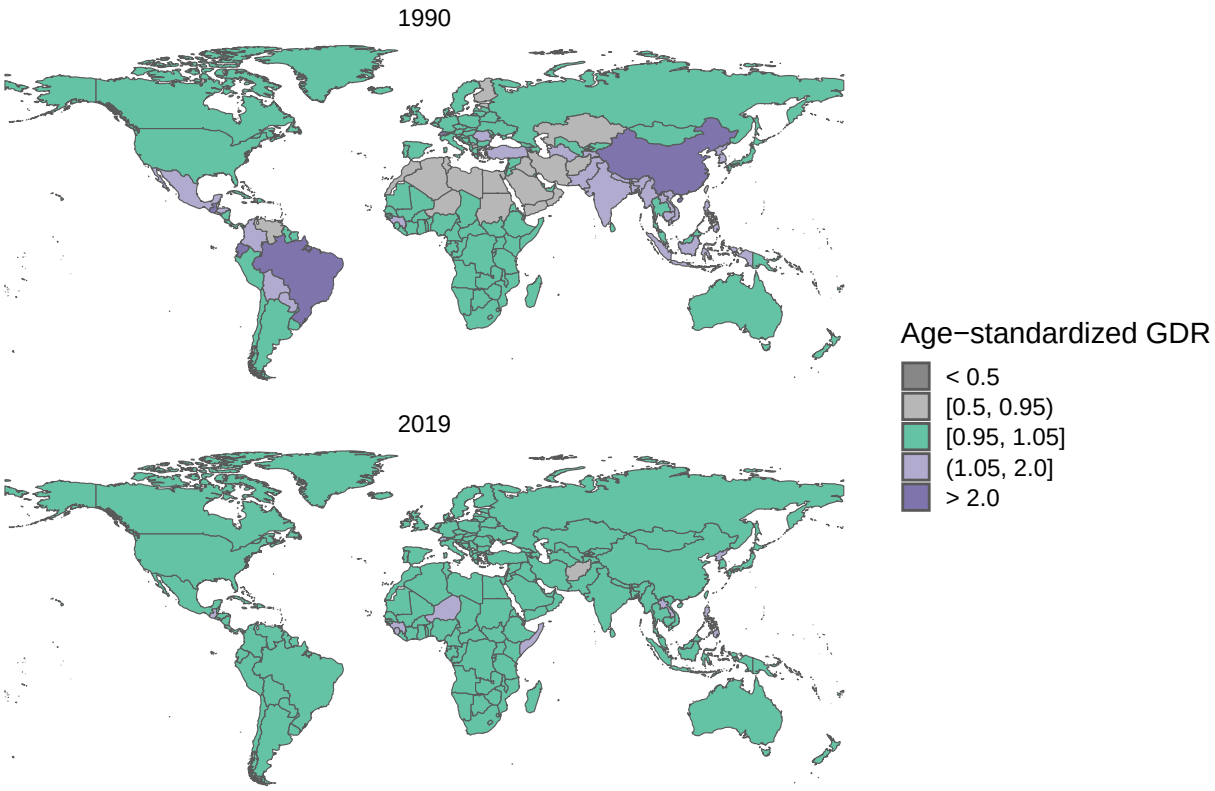



```r
# dev.copy(tiff, "figures/Figure3.tiff", width = 20, height = 10, units = "cm", res = 300)
# dev.off()
```

GDR

```r
# install.packages(c("cowplot", "googleway", "ggplot2", "ggrepel",
#                    "ggspatial", "libwgeom", "sf", "rnaturalearth", "rnaturalearthdata", "rgeos", "have

library("haven")
library("readstata13")
library("dplyr")
```

```r
library("tidyr")
library("ggplot2")
theme_set(theme_bw())
library("sf")
library("rnaturalearth")
library("rnaturalearthdata")
library("rgeos")
gdr_data = merge(main_data, iso3, by = 'location_id')
gdr_data$Location = gdr_data$location_id
gdr_data$QCI = gdr_data$pca
gdr_data$iso = gdr_data$iso3_countries
data2 = filter(gdr_data, year %in% c(1990, 2019), sex_name %in% c('Male', 'Female'), age_name == "Age-s
data3 = select(data2, location_id, iso, sex_name, year, QCI)
data4 = spread(data3, sex_name, QCI)
data4$GDR = data4$Female/data4$Male

breaks <- c(0, 0.5, 0.95, 1.05, 2.0, Inf)
labels <- c("< 0.5", "[0.5, 0.95)", "[0.95, 1.05]", "(1.05, 2.0]", "> 2.0")
data4$quantile <- cut(data4$GDR, breaks = breaks, labels = labels, include.lowest = TRUE)

world = ne_countries(scale = "medium", returnclass = "sf")
world$iso = world$iso_a3
world = merge(world, data4, by = 'iso')

ggplot(data = world) +
        geom_sf(aes(fill = quantile)) +
        scale_fill_manual(values = c("#878787", "#b7b7b7", "#64c2a5", "#b1abd0", "#7f74ac"), name = "Ag
        theme_void() +
        facet_wrap(~ year, ncol = 1) +
        theme(legend.key.size = unit(0.4, 'cm'))
```




```
# dev.copy(tiff, "figures/Figure2.tiff", width = 20, height = 10, units = "cm", res = 300)

dev.off()
```

```
## null device
##           1
```

```
data3 = select(data2, Location, QCI)
```