Dengue raw data cleaner

Table of contents

Load libraries

```
.pkgs <- c("tidyverse", "janitor", "fs", "readxl", "skimr", "stringi")
xfun::pkg_attach(.pkgs)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4          v readr     2.1.5
v forcats   1.0.0          v stringr   1.5.1
v ggplot2   3.5.1.9000     v tibble    3.2.1
v lubridate 1.9.4          v tidyr     1.3.1
v purrr     1.0.2
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom

Attaching package: 'janitor'


The following objects are masked from 'package:stats':

    chisq.test, fisher.test
```

```
set_theme(theme_bw())
```

Data ingestion

Read raw excel files and quickly clean column names with `janitor::clean_names()`

```
xlsx_raws <- dir_ls("incidence_data_2000_2022", regexp = "xlsx") %>%
  map(
    ~ map(excel_sheets(.x), \(sh) suppressWarnings(read_excel(.x, sheet = sh)) %>% clean_name
  ) %>%
  flatten() %>%
  set_names(NULL)
```

Our columns of interest are: "sex", "age", "date of admission", "district (of patient's residential address)", "commune (of patient's residential address)", "hospital", "icd", "in-/out-patient"

EDA and data cleaning

There are 2 excel files, first file contains cases from 2000-2016, a separate sheet for each year. Second find contains cases from 2017-2022, all in one sheet. The 2 files contains 2 different format of columns because they come from 2 different reporting systems.

Data from 2000-2016

First we will look at data from 2000-2016

We can look at mismatched columns for all the sheets

```
compare_df_cols(xlsx_raws[-length(xlsx_raws)], return = "mismatch")
```

```
  column_name xlsx_raws[-length(xlsx_raws)]_1 xlsx_raws[-length(xlsx_raws)]_2
1   cd_ravien                         logical                         logical
2       ng_bc                 POSIXct, POSIXt                 POSIXct, POSIXt
3   ng_tuvong                         logical                         logical
  xlsx_raws[-length(xlsx_raws)]_3 xlsx_raws[-length(xlsx_raws)]_4
1                         logical                         logical
2                 POSIXct, POSIXt                         logical
3                         logical                         logical
  xlsx_raws[-length(xlsx_raws)]_5 xlsx_raws[-length(xlsx_raws)]_6
1                         logical                         logical
2                 POSIXct, POSIXt                 POSIXct, POSIXt
3                         logical                 POSIXct, POSIXt
  xlsx_raws[-length(xlsx_raws)]_7 xlsx_raws[-length(xlsx_raws)]_8
1                         logical                       character
2                 POSIXct, POSIXt                 POSIXct, POSIXt
3                         logical                 POSIXct, POSIXt
  xlsx_raws[-length(xlsx_raws)]_9 xlsx_raws[-length(xlsx_raws)]_10
1                       character                        character
2                 POSIXct, POSIXt                  POSIXct, POSIXt
3                 POSIXct, POSIXt                  POSIXct, POSIXt
  xlsx_raws[-length(xlsx_raws)]_11 xlsx_raws[-length(xlsx_raws)]_12
1                        character                             <NA>
2                  POSIXct, POSIXt                  POSIXct, POSIXt
```

```
3                          logical                  POSIXct, POSIXt
  xlsx_raws[-length(xlsx_raws)]_13 xlsx_raws[-length(xlsx_raws)]_14
1                        character                        character
2                  POSIXct, POSIXt                  POSIXct, POSIXt
3                          logical                          logical
  xlsx_raws[-length(xlsx_raws)]_15 xlsx_raws[-length(xlsx_raws)]_16
1                        character                        character
2                  POSIXct, POSIXt                  POSIXct, POSIXt
3                  POSIXct, POSIXt                  POSIXct, POSIXt
  xlsx_raws[-length(xlsx_raws)]_17
1                        character
2                  POSIXct, POSIXt
3                  POSIXct, POSIXt
```

Mismatched columns `cd_ravien`, `ng_bc`, `ng_tuvong` are insignificant, so we will go ahead with row binding all the sheets together ::: {.callout-note} `xlsx_raws[-length(xlsx_raws)]` means look at all sheets from first file, ignore last sheet (i.e. second file) :::

```
raw_2000_2016 <- xlsx_raws[-length(xlsx_raws)] %>% bind_rows()
```

Skimming to see what's going on in the data

```
skim(raw_2000_2016)
```

Table 1: Data summary

Name	raw_2000_2016
Number of rows	147927
Number of columns	33
Column type frequency:	
character	12
logical	14
numeric	2
POSIXct	5
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
maso	43969	0.70	1	15	0	88299	0
hoten	0	1.00	3	39	0	110896	0
gioi	6351	0.96	1	1	0	7	0
diachi	5557	0.96	1	92	0	133295	0
px	0	1.00	2	16	0	171	0
qh	0	1.00	2	10	0	24	0
ma_tinh	0	1.00	3	3	0	1	0
cd_ravien	96007	0.35	14	14	0	1	0
nguon_du_lieu	0	1.00	7	18	0	40	0
do_sxh	31125	0.79	1	1	0	15	0
m_icd	7495	0.95	3	6	0	37	0
naso	144843	0.02	4	10	0	3082	0

Variable type: logical

skim_variable	n_missing	complete_rate	mean	count
ma_moi_bc	147927	0	NaN	:
ap	147927	0	NaN	:
ten_cha	147927	0	NaN	:
laymauxetnghiem	147927	0	NaN	:
elisa	147927	0	NaN	:
plvr	147927	0	NaN	:
ns1	147927	0	NaN	:
odn	147927	0	NaN	:
ng_khoibenh	147927	0	NaN	:
cd_vaovien	147927	0	NaN	:
ly_do_tu_vong	147927	0	NaN	:
nv_nhap	147927	0	NaN	:
ng_hieuchinh	147927	0	NaN	:
ghi_chu	147927	0	NaN	:

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
tuoi	22100	0.85	16.33	240.8	- 34669	8	13	22	2015	
ng_sinh	32149	0.78	1994.34	251.0	0	1988	1996	2003	36685	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ng_vaovien	0	1.00	2000-01-01	2016-12-31 22:14:28	2010-04-19 00:00:00	8103
ng_ravien	1411	0.99	1900-01-22	2017-03-16 00:00:00	2010-07-21 00:00:00	7109
ng_tuvong	147875	0.00	2000-09-09	2011-11-25 00:00:00	2008-10-27 12:00:00	52
ng_bc	56911	0.62	2000-01-07	2017-03-22 00:00:00	2007-11-29 00:00:00	4101
ng_nhap	364	1.00	2000-01-07	2017-03-24 00:00:00	2010-05-07 00:00:00	2033

The actual columns based on our columns of interest are (with `complete_rate`): - `sex` = `gioi` (0.957) - `age` = `tuoi` (0.851); `ng_sinh` (0.873); year of birth might be in `hoten` col - `date of admission` = `ng_vaovien` (1) - `district` = `qh` (1) - `commune` = `px` (1) - `hospital` = `nguon_du_lieu` (1) - `icd` = `m_icd` (0.949) - `in-patient` = this is all in-patient data

Selecting columns of interest

```
s1_2000_2016 <- raw_2000_2016 %>%
  select(hoten, gioi, tuoi, ng_sinh, ng_vaovien, qh, px, nguon_du_lieu, m_icd)
# s1_2000_2016
```

Keeping track of raw number of rows at start to see how much lost during data cleaning

```
start_nrow <- nrow(s1_2000_2016)
start_nrow
```

```
[1] 147927
```

Fix age if possible

Some year of births (YOBs) are stored in the name (`hoten`) column, let's see how much of the data is like this

```
s1_2000_2016 %>%
  select(hoten, tuoi, ng_sinh) %>%
  filter(is.na(tuoi)) %>%
  rowwise() %>%
  mutate(no_age = any(
    varhandle::check.numeric(hoten),
    !is.na(ng_sinh)
  )) %>%
  tabyl(no_age)
```

```
 no_age     n     percent
  FALSE 21898 0.990859729
   TRUE   202 0.009140271
```

Less than 1% of the data has YOB in the name column and able to get age from YOB, so it's not worth going deeper.

For now, people with no age will have `NA` as their age

Rename columns

```
s2_2000_2016 <- s1_2000_2016 %>%
  select(-hoten, -ng_sinh) %>%
  rename(
    sex = gioi,
    age = tuoi,
    date = ng_vaovien,
    district = qh,
    commune = px,
    hospital = nguon_du_lieu,
    icd = m_icd
  ) %>%
  mutate(
    in_out_patient = "in-patient"
  )
# s2_2000_2016
```

Fix dates data

Date data is in `datetime`, convert to `date` only

```
s3_2000_2016 <- s2_2000_2016 %>%
  mutate(date = convert_to_date(date))
# s3_2000_2016
```

```
skim(s3_2000_2016)
```

Table 6: Data summary

Name	s3_2000_2016
Number of rows	147927
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	6351	0.96	1	1	0	7	0
district	0	1.00	2	10	0	24	0
commune	0	1.00	2	16	0	171	0
hospital	0	1.00	7	18	0	40	0
icd	7495	0.95	3	6	0	37	0
in_out_patient	0	1.00	10	10	0	1	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2000-01-01	2016-12-31	2010-04-19	6184

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	22100	0.85	16.33	240.8	-34669	8	13	22	2015	

We see that there are 7 unique sexes, 37 unique ICDs, negative age. Let's clean all of this

Fix sexes

Look into `sex` column first

```
s3_2000_2016 %>% tabyl(sex)
```

```
  sex     n      percent valid_percent
    1     1 6.760091e-06  7.063344e-06
    G 59814 4.043481e-01  4.224869e-01
    I  9073 6.133431e-02  6.408572e-02
    N   890 6.016481e-03  6.286376e-03
    T 71786 4.852799e-01  5.070492e-01
    g     4 2.704036e-05  2.825338e-05
    t     8 5.408073e-05  5.650675e-05
 <NA>  6351 4.293334e-02            NA
```

Impossible to know what "I" and "N" means skip this for now as it's not that important

Fix ICD

```
s3_2000_2016 %>%
  mutate(year = year(date)) %>%
  tabyl(icd, year)
```

```
    icd 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
    A90    0    0    0    0    0    0    0    0    0    0  140  937   15    1
    a91    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    A91  375  556  865 2680 3329 2526 2955 1180 3672 1378   38  146    9   20
  A91-1    0   30   31   55   64   52   78  129   83  137  225   30    4    0
  A91-2    6  456  571 1300 1187  994 1807 2437 2278 2686 2241  480   11    0
  A91-3    0   74   99  325  194  115  151  280  355  389  334   79    1    0
```

```
 A91-4    0    7   10   15   11    4   16   17   13   35   27    9    0    0
 A91-E    0    0    0    0    0    0    0    0    0    0    0    0    2    1
  A91.    0    0    0    0    0    0    0    0    0    0    9    5    0    0
 A91.]    0    0    0    0    0    0    0    1    0    0    0    0    0    0
 A91.`    0    0    0    0    0    0    0    1    0    0    0    0    0    0
 A91.0    5    8    4    6    0    1    0    4    0    2    0    0    0    0
 A91.1  946  979  657 1769  748  814  947 1368 1516 1319   62  223    0    0
 A91.2  647  548  428 1791 1538 1469 2221 3424 5631 4723  200  542    0    0
 A91.3  147  133  119  407  227  151  198  251  613  411   21   61    0    0
 A91.4   10   11    6   29   13    8    8   11   66   31    1    0    0    0
 A91.9    0    0    0    0    0    0    0    0    3    0    0    0    0    0
 A91.a    0    0    0    0    0    0    0    0    0    0    0 5042 6128 4333
 A91.A    0    0    0    0    0    0    0    0    0    0    0 1071 1279  977
 A91.b    0    0    0    0    0    0    0    0    0    0    0 1024 1067  810
 A91.B    0    0    0    0    0    0    0    0    0    0    0  125  333  271
 A91.c    0    0    0    0    0    0    0    0    0    0    0  250  224  140
 A91.C    0    0    0    0    0    0    0    0    0    0    0    3   20   16
A91.c1    0    0    0    0    0    0    0    0    0    0    0  105  164  113
A91.C1    0    0    0    0    0    0    0    0    0    0    0  212  259  172
A91.c2    0    0    0    0    0    0    0    0    0    0    0    6    2    3
A91.C2    0    0    0    0    0    0    0    0    0    0    0   11   28   32
A91.c3    0    0    0    0    0    0    0    0    0    0    0    6    0    3
A91.C3    0    0    0    0    0    0    0    0    0    0    0    1    1    0
A91.c4    0    0    0    0    0    0    0    0    0    0    0   10   10   15
A91.C4    0    0    0    0    0    0    0    0    0    0    0    0    2    1
 a99.1    0    0    0    0    0    0    0    0    0    0    0    4    0    0
 A99.1    0    0    0    0    0    0    0    0    0    0    3   26    0    0
 A99.2    0    0    0    0    0    0    0    0    0    0   12  478    0    0
 a99.3    0    0    0    0    0    0    0    0    0    0    0    4    0    0
 A99.3    0    0    0    0    0    0    0    0    0    0    2   37    0    0
 A99.4    0    0    0    0    0    0    0    0    0    0    0    5    0    0
  <NA>    0    0    0    0    0    0    0    0    0    0 6373  888  233    1
2014 2015 2016
   0    0    0
   0    2   10
  21  256 6980
   0    0    0
   0    0    0
   0    0    0
   0    0    0
   0    0    0
   0    0    0
   0    0    0
```

```
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
 3950 7625 7367
 1101 1207 1400
  960 2080 2094
  256  266  193
   45  129  107
   19   22    6
  147  196  219
  151  143  141
    3    4    4
   24   30   12
    2    7    9
    0    0    1
   30   58   66
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
    0    0    0
```

Needs to consult dengue experts on this, skip for now

Fix age, again

```
s3_2000_2016 %>% tabyl(age)
```

```
    age     n      percent valid_percent
 -34669     1 6.760091e-06  7.947420e-06
 -31868     1 6.760091e-06  7.947420e-06
 -31450     1 6.760091e-06  7.947420e-06
 -30781     1 6.760091e-06  7.947420e-06
```

```
-28917     1 6.760091e-06  7.947420e-06
-26725     1 6.760091e-06  7.947420e-06
-17994     1 6.760091e-06  7.947420e-06
-17993     2 1.352018e-05  1.589484e-05
 -4670     1 6.760091e-06  7.947420e-06
  -297     1 6.760091e-06  7.947420e-06
    -2     1 6.760091e-06  7.947420e-06
     0  2237 1.512232e-02  1.777838e-02
     1  4871 3.292840e-02  3.871188e-02
     2  2895 1.957046e-02  2.300778e-02
     3  2976 2.011803e-02  2.365152e-02
     4  3380 2.284911e-02  2.686228e-02
     5  3941 2.664152e-02  3.132078e-02
     6  4782 3.232676e-02  3.800456e-02
     7  5278 3.567976e-02  4.194648e-02
     8  5456 3.688306e-02  4.336112e-02
     9  5494 3.713994e-02  4.366312e-02
    10  5964 4.031718e-02  4.739841e-02
    11  5956 4.026310e-02  4.733483e-02
    12  6053 4.091883e-02  4.810573e-02
    13  6165 4.167596e-02  4.899584e-02
    14  5786 3.911389e-02  4.598377e-02
    15  3881 2.623591e-02  3.084394e-02
    16  2565 1.733963e-02  2.038513e-02
    17  2435 1.646082e-02  1.935197e-02
    18  2850 1.926626e-02  2.265015e-02
    19  2925 1.977327e-02  2.324620e-02
    20  3090 2.088868e-02  2.455753e-02
    21  2946 1.991523e-02  2.341310e-02
    22  2863 1.935414e-02  2.275346e-02
    23  2757 1.863757e-02  2.191104e-02
    24  2519 1.702867e-02  2.001955e-02
    25  2241 1.514936e-02  1.781017e-02
    26  2141 1.447336e-02  1.701543e-02
    27  1966 1.329034e-02  1.562463e-02
    28  1894 1.280361e-02  1.505241e-02
    29  1720 1.162736e-02  1.366956e-02
    30  1608 1.087023e-02  1.277945e-02
    31  1440 9.734531e-03  1.144428e-02
    32  1368 9.247805e-03  1.087207e-02
    33  1190 8.044508e-03  9.457430e-03
    34   967 6.537008e-03  7.685155e-03
    35   931 6.293645e-03  7.399048e-03
```

```
36   857 5.793398e-03  6.810939e-03
37   770 5.205270e-03  6.119513e-03
38   670 4.529261e-03  5.324771e-03
39   569 3.846492e-03  4.522082e-03
40   531 3.589608e-03  4.220080e-03
41   484 3.271884e-03  3.846551e-03
42   397 2.683756e-03  3.155126e-03
43   377 2.548554e-03  2.996177e-03
44   302 2.041548e-03  2.400121e-03
45   295 1.994227e-03  2.344489e-03
46   270 1.825225e-03  2.145803e-03
47   240 1.622422e-03  1.907381e-03
48   215 1.453420e-03  1.708695e-03
49   183 1.237097e-03  1.454378e-03
50   213 1.439899e-03  1.692800e-03
51   204 1.379059e-03  1.621274e-03
52   140 9.464128e-04  1.112639e-03
53   127 8.585316e-04  1.009322e-03
54   121 8.179710e-04  9.616378e-04
55   109 7.368499e-04  8.662688e-04
56   105 7.098096e-04  8.344791e-04
57    74 5.002467e-04  5.881091e-04
58   116 7.841706e-04  9.219007e-04
59    73 4.934867e-04  5.801617e-04
60    66 4.461660e-04  5.245297e-04
61    55 3.718050e-04  4.371081e-04
62    63 4.258857e-04  5.006875e-04
63    51 3.447646e-04  4.053184e-04
64    50 3.380046e-04  3.973710e-04
65    37 2.501234e-04  2.940545e-04
66    27 1.825225e-04  2.145803e-04
67    29 1.960426e-04  2.304752e-04
68    28 1.892826e-04  2.225278e-04
69    26 1.757624e-04  2.066329e-04
70    33 2.230830e-04  2.622649e-04
71    23 1.554821e-04  1.827907e-04
72    23 1.554821e-04  1.827907e-04
73    17 1.149215e-04  1.351061e-04
74    15 1.014014e-04  1.192113e-04
75    12 8.112109e-05  9.536904e-05
76    13 8.788118e-05  1.033165e-04
77     6 4.056055e-05  4.768452e-05
78     8 5.408073e-05  6.357936e-05
```

```
  79      9 6.084082e-05  7.152678e-05
  80     21 1.419619e-04  1.668958e-04
  81     13 8.788118e-05  1.033165e-04
  82      8 5.408073e-05  6.357936e-05
  83      4 2.704036e-05  3.178968e-05
  84      5 3.380046e-05  3.973710e-05
  85      3 2.028027e-05  2.384226e-05
  86      2 1.352018e-05  1.589484e-05
  87      3 2.028027e-05  2.384226e-05
  88      3 2.028027e-05  2.384226e-05
  90     25 1.690023e-04  1.986855e-04
  91      5 3.380046e-05  3.973710e-05
  92      5 3.380046e-05  3.973710e-05
  93      1 6.760091e-06  7.947420e-06
  94      1 6.760091e-06  7.947420e-06
  99      1 6.760091e-06  7.947420e-06
 103      1 6.760091e-06  7.947420e-06
 106      1 6.760091e-06  7.947420e-06
 117      1 6.760091e-06  7.947420e-06
 120      1 6.760091e-06  7.947420e-06
1816      1 6.760091e-06  7.947420e-06
1825      1 6.760091e-06  7.947420e-06
1952      1 6.760091e-06  7.947420e-06
1954      1 6.760091e-06  7.947420e-06
1957      1 6.760091e-06  7.947420e-06
1958      1 6.760091e-06  7.947420e-06
1959      1 6.760091e-06  7.947420e-06
1962      3 2.028027e-05  2.384226e-05
1964      2 1.352018e-05  1.589484e-05
1970      2 1.352018e-05  1.589484e-05
1972      4 2.704036e-05  3.178968e-05
1973      1 6.760091e-06  7.947420e-06
1974      2 1.352018e-05  1.589484e-05
1975      3 2.028027e-05  2.384226e-05
1977      1 6.760091e-06  7.947420e-06
1978      2 1.352018e-05  1.589484e-05
1981      1 6.760091e-06  7.947420e-06
1982      1 6.760091e-06  7.947420e-06
1983      3 2.028027e-05  2.384226e-05
1984      2 1.352018e-05  1.589484e-05
1985      4 2.704036e-05  3.178968e-05
1986      3 2.028027e-05  2.384226e-05
1987      3 2.028027e-05  2.384226e-05
```

```
  1988     2 1.352018e-05  1.589484e-05
  1989     4 2.704036e-05  3.178968e-05
  1990     2 1.352018e-05  1.589484e-05
  1991     6 4.056055e-05  4.768452e-05
  1992     4 2.704036e-05  3.178968e-05
  1993     7 4.732064e-05  5.563194e-05
  1994     5 3.380046e-05  3.973710e-05
  1995     4 2.704036e-05  3.178968e-05
  1996     4 2.704036e-05  3.178968e-05
  1997     7 4.732064e-05  5.563194e-05
  1998     3 2.028027e-05  2.384226e-05
  1999     3 2.028027e-05  2.384226e-05
  2000     5 3.380046e-05  3.973710e-05
  2001     2 1.352018e-05  1.589484e-05
  2002     5 3.380046e-05  3.973710e-05
  2003     3 2.028027e-05  2.384226e-05
  2004     2 1.352018e-05  1.589484e-05
  2005     2 1.352018e-05  1.589484e-05
  2006     2 1.352018e-05  1.589484e-05
  2007     5 3.380046e-05  3.973710e-05
  2008     5 3.380046e-05  3.973710e-05
  2009     5 3.380046e-05  3.973710e-05
  2010     2 1.352018e-05  1.589484e-05
  2011     4 2.704036e-05  3.178968e-05
  2012     4 2.704036e-05  3.178968e-05
  2013     2 1.352018e-05  1.589484e-05
  2014     2 1.352018e-05  1.589484e-05
  2015     2 1.352018e-05  1.589484e-05
    NA 22100 1.493980e-01            NA
```

There are a lot of YOB that are put in as age, let's quickly fix that

```
s3_2000_2016 %>%
  mutate(age = if_else(age > 1000, year(date) - age, age)) %>%
  tabyl(age)
```

```
   age     n      percent valid_percent
-34669     1 6.760091e-06  7.947420e-06
-31868     1 6.760091e-06  7.947420e-06
-31450     1 6.760091e-06  7.947420e-06
-30781     1 6.760091e-06  7.947420e-06
-28917     1 6.760091e-06  7.947420e-06
```

```
-26725      1 6.760091e-06  7.947420e-06
-17994      1 6.760091e-06  7.947420e-06
-17993      2 1.352018e-05  1.589484e-05
 -4670      1 6.760091e-06  7.947420e-06
  -297      1 6.760091e-06  7.947420e-06
    -2      1 6.760091e-06  7.947420e-06
     0   2246 1.518316e-02  1.784991e-02
     1   4873 3.294192e-02  3.872778e-02
     2   2897 1.958398e-02  2.302368e-02
     3   2977 2.012479e-02  2.365947e-02
     4   3381 2.285587e-02  2.687023e-02
     5   3943 2.665504e-02  3.133668e-02
     6   4783 3.233352e-02  3.801251e-02
     7   5283 3.571356e-02  4.198622e-02
     8   5461 3.691686e-02  4.340086e-02
     9   5499 3.717374e-02  4.370286e-02
    10   5966 4.033070e-02  4.741431e-02
    11   5958 4.027662e-02  4.735073e-02
    12   6055 4.093235e-02  4.812163e-02
    13   6166 4.168272e-02  4.900379e-02
    14   5791 3.914769e-02  4.602351e-02
    15   3883 2.624943e-02  3.085983e-02
    16   2570 1.737343e-02  2.042487e-02
    17   2438 1.648110e-02  1.937581e-02
    18   2853 1.928654e-02  2.267399e-02
    19   2932 1.982059e-02  2.330184e-02
    20   3095 2.092248e-02  2.459726e-02
    21   2950 1.994227e-02  2.344489e-02
    22   2868 1.938794e-02  2.279320e-02
    23   2764 1.868489e-02  2.196667e-02
    24   2524 1.706247e-02  2.005929e-02
    25   2247 1.518992e-02  1.785785e-02
    26   2143 1.448688e-02  1.703132e-02
    27   1970 1.331738e-02  1.565642e-02
    28   1896 1.281713e-02  1.506831e-02
    29   1723 1.164764e-02  1.369340e-02
    30   1611 1.089051e-02  1.280329e-02
    31   1443 9.754811e-03  1.146813e-02
    32   1370 9.261325e-03  1.088797e-02
    33   1193 8.064789e-03  9.481272e-03
    34    968 6.543768e-03  7.693102e-03
    35    931 6.293645e-03  7.399048e-03
    36    857 5.793398e-03  6.810939e-03
```

```
37   770 5.205270e-03  6.119513e-03
38   672 4.542781e-03  5.340666e-03
39   570 3.853252e-03  4.530029e-03
40   531 3.589608e-03  4.220080e-03
41   487 3.292164e-03  3.870393e-03
42   399 2.697276e-03  3.171021e-03
43   378 2.555314e-03  3.004125e-03
44   306 2.068588e-03  2.431910e-03
45   295 1.994227e-03  2.344489e-03
46   272 1.838745e-03  2.161698e-03
47   240 1.622422e-03  1.907381e-03
48   215 1.453420e-03  1.708695e-03
49   183 1.237097e-03  1.454378e-03
50   213 1.439899e-03  1.692800e-03
51   204 1.379059e-03  1.621274e-03
52   142 9.599329e-04  1.128534e-03
53   127 8.585316e-04  1.009322e-03
54   124 8.382513e-04  9.854801e-04
55   109 7.368499e-04  8.662688e-04
56   105 7.098096e-04  8.344791e-04
57    75 5.070068e-04  5.960565e-04
58   117 7.909307e-04  9.298481e-04
59    74 5.002467e-04  5.881091e-04
60    66 4.461660e-04  5.245297e-04
61    55 3.718050e-04  4.371081e-04
62    64 4.326458e-04  5.086349e-04
63    51 3.447646e-04  4.053184e-04
64    51 3.447646e-04  4.053184e-04
65    37 2.501234e-04  2.940545e-04
66    27 1.825225e-04  2.145803e-04
67    29 1.960426e-04  2.304752e-04
68    28 1.892826e-04  2.225278e-04
69    26 1.757624e-04  2.066329e-04
70    33 2.230830e-04  2.622649e-04
71    23 1.554821e-04  1.827907e-04
72    23 1.554821e-04  1.827907e-04
73    17 1.149215e-04  1.351061e-04
74    15 1.014014e-04  1.192113e-04
75    12 8.112109e-05  9.536904e-05
76    13 8.788118e-05  1.033165e-04
77     6 4.056055e-05  4.768452e-05
78     8 5.408073e-05  6.357936e-05
79     9 6.084082e-05  7.152678e-05
```

```
 80    21 1.419619e-04  1.668958e-04
 81    13 8.788118e-05  1.033165e-04
 82     8 5.408073e-05  6.357936e-05
 83     4 2.704036e-05  3.178968e-05
 84     5 3.380046e-05  3.973710e-05
 85     3 2.028027e-05  2.384226e-05
 86     2 1.352018e-05  1.589484e-05
 87     3 2.028027e-05  2.384226e-05
 88     3 2.028027e-05  2.384226e-05
 90    25 1.690023e-04  1.986855e-04
 91     5 3.380046e-05  3.973710e-05
 92     5 3.380046e-05  3.973710e-05
 93     1 6.760091e-06  7.947420e-06
 94     1 6.760091e-06  7.947420e-06
 99     1 6.760091e-06  7.947420e-06
103     1 6.760091e-06  7.947420e-06
106     1 6.760091e-06  7.947420e-06
117     1 6.760091e-06  7.947420e-06
120     1 6.760091e-06  7.947420e-06
191     1 6.760091e-06  7.947420e-06
200     1 6.760091e-06  7.947420e-06
 NA 22100 1.493980e-01            NA
```

Then let's drop negative age and age > 90

```
s4_2000_2016 <- s3_2000_2016 %>%
  mutate(age = if_else(age > 1000, year(date) - age, age)) %>%
  filter(age >= 0, age < 91)

s4_2000_2016 %>% skim()
```

Table 10: Data summary

Name	Piped data
Number of rows	125796
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1

Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	2774	0.98	1	1	0	7	0
district	0	1.00	2	10	0	24	0
commune	0	1.00	2	16	0	171	0
hospital	0	1.00	7	18	0	37	0
icd	5280	0.96	3	6	0	35	0
in_out_patient	0	1.00	10	10	0	1	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2000-01-01	2016-12-31	2011-01-29	6128

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	15.95	11.67	0	8	13	22	90	

Wrap up

Probably finished cleaning 2000-2016 data for now

Let's check final number of rows

```
nrow(s4_2000_2016)
```

```
[1] 125796
```

```
start_nrow - nrow(s4_2000_2016)
```

```
[1] 22131
```

```
(start_nrow - nrow(s4_2000_2016)) / start_nrow * 100
```

```
[1] 14.96076
```

Lost about 15% of rows

Data from 2017-2022

Extract the data

```
raw_2017_2022 <- xlsx_raws[length(xlsx_raws)][[1]]
```

Quick skim at the data

```
skim(raw_2017_2022)
```

Table 14: Data summary

Name	raw_2017_2022
Number of rows	268738
Number of columns	21
Column type frequency:	
character	15
numeric	2
POSIXct	4
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
gioi	0	1.00	2	3	0	11	0
tinh_noi_o	0	1.00	5	9	0	3	0
quan_huyen_noi_o	0	1.00	6	16	0	25	0
phuong_xa_noi_o	0	1.00	8	23	0	181	0
tinh_trang_hien_tai	46	1.00	2	170	0	180	0
don_vi_bao_cao	1	1.00	4	56	0	530	0

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
tinh_bao_cao	135	1.00	3	20	0	70	0
phan_do	201045	0.25	1	2	0	15	0
lay_mau	21313	0.92	2	25	0	128	0
ngay_lay_mau	194951	0.27	2	22	0	2498	0
loai_xet_nghiem	144446	0.46	3	54	0	34	0
ket_qua_xet_nghiem	147225	0.45	4	15	0	13	0
don_vi_xet_nghiem	235984	0.12	4	66	0	340	0
x1_mabtt	0	1.00	2	2	0	1	0
benh_kem	265104	0.01	1	255	0	1365	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
stt	0	1	134369.50	77578.12	1	67185.25	134369.5	201553.8	268738	
tuoi	39	1	22.45	27.14	-7974	11.00	20.0	31.0	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ngay_khoi_phat	8881	0.97	1974-10-29	2219-06-14	2019-10-08	2252
ngay_nhap_vien	0	1.00	2017-01-01	2022-12-31	2019-10-26	2191
ngay_xuat_vien	192154	0.28	1899-12-31	2023-02-21	2019-01-09	2155
ngay_bao_cao	0	1.00	2018-01-02	2023-02-22	2019-10-31	1087

The actual columns based on our columns of interest are (with `complete_rate`): `- sex` = `gioi` (1) `- age` = `tuoi` (1.00) `- date of admission` = `ngay_nhap_vien` (1) `- district` = `quan_huyen_noi_o` (1) `- commune` = `phuong_xa_noi_o` (1) `- hospital` = `don_vi_bao_cao` (1.00) – lots of cases out of HCMC -> filter with `tinh_bao_cao` (0.999) `- icd` = `phan_do` (0.252) `- in-patient` = `tinh_trang_hien_tai` (1.00) – very complex freetext

Selecting columns of interest

```
s1_2017_2022 <- raw_2017_2022 %>%
  select(
    gioi, tuoi, ngay_nhap_vien, quan_huyen_noi_o, phuong_xa_noi_o,
    don_vi_bao_cao, tinh_bao_cao, phan_do, tinh_trang_hien_tai
  )
s1_2017_2022 %>% skim()
```

Table 18: Data summary

Name	Piped data
Number of rows	268738
Number of columns	9
Column type frequency:	
character	7
numeric	1
POSIXct	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
gioi	0	1.00	2	3	0	11	0
quan_huyen_noi_o	0	1.00	6	16	0	25	0
phuong_xa_noi_o	0	1.00	8	23	0	181	0
don_vi_bao_cao	1	1.00	4	56	0	530	0
tinh_bao_cao	135	1.00	3	20	0	70	0
phan_do	201045	0.25	1	2	0	15	0
tinh_trang_hien_tai	46	1.00	2	170	0	180	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
tuoi	39	1	22.45	27.14	-7974	11	20	31	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ngay_nhap_vien	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Keeping track of raw number of rows at start to see how much lost during data cleaning

```r
start_nrow2 <- nrow(s1_2017_2022)
start_nrow2
```

```
[1] 268738
```

Filter cases outside of HCMC

First, let's filter out cases that are reported outside of HCMC.

```r
s1_2017_2022 %>% tabyl(tinh_bao_cao)
```

```
           tinh_bao_cao      n      percent valid_percent
               An Giang    260 9.674851e-04  9.679713e-04
             BV An Sinh      6 2.232658e-05  2.233780e-05
          Bà Rịa-V.Tàu    126 4.688581e-04  4.690938e-04
             Bình Dương   2514 9.354836e-03  9.359538e-03
             Bình Phước     13 4.837425e-05  4.839857e-05
            Bình Thuận     44 1.637282e-04  1.638105e-04
              Bình Định    105 3.907151e-04  3.909115e-04
              Bạc Liêu     24 8.930631e-05  8.935120e-05
              Bắc Ninh      2 7.442193e-06  7.445933e-06
               Bến Tre    182 6.772395e-04  6.775799e-04
    Bệnh viện Nhi đồng 1    192 7.144505e-04  7.148096e-04
    Bệnh viện Nhi đồng 2     60 2.232658e-04  2.233780e-04
       Bệnh viện Quận 4     10 3.721096e-05  3.722967e-05
                 Cà Mau     24 8.930631e-05  8.935120e-05
                Cần Thơ     91 3.386198e-04  3.387900e-04
               Gia Lai     14 5.209535e-05  5.212153e-05
                   HCM     12 4.465316e-05  4.467560e-05
                Hà Nam      1 3.721096e-06  3.722967e-06
                Hà Nội     34 1.265173e-04  1.265809e-04
```

```
        Hà Tĩnh      1 3.721096e-06  3.722967e-06
       Hưng Yên      2 7.442193e-06  7.445933e-06
      Hải Dương      5 1.860548e-05  1.861483e-05
      Hải Phòng      7 2.604767e-05  2.606077e-05
      Hậu Giang     20 7.442193e-05  7.445933e-05
    Hồ Chí Minh     16 5.953754e-05  5.956747e-05
      Khánh Hòa    113 4.204839e-04  4.206952e-04
     Kiên Giang     53 1.972181e-04  1.973172e-04
        Kon Tum      3 1.116329e-05  1.116890e-05
        Long An    378 1.406574e-03  1.407281e-03
        Lào Cai      1 3.721096e-06  3.722967e-06
       Lâm Đồng    126 4.688581e-04  4.690938e-04
       Nam Định      3 1.116329e-05  1.116890e-05
        Nghệ An      3 1.116329e-05  1.116890e-05
     Ninh Thuận     15 5.581645e-05  5.584450e-05
        Phú Yên     70 2.604767e-04  2.606077e-04
     Quảng Bình      6 2.232658e-05  2.233780e-05
      Quảng Nam     50 1.860548e-04  1.861483e-04
     Quảng Ngãi    119 4.428105e-04  4.430330e-04
     Quảng Ninh      3 1.116329e-05  1.116890e-05
      Quảng Trị      8 2.976877e-05  2.978373e-05
      Sóc Trăng     54 2.009392e-04  2.010402e-04
     TP . H.C.M      1 3.721096e-06  3.722967e-06
         TP HCM      1 3.721096e-06  3.722967e-06
 TP Hồ Chí Minh      8 2.976877e-05  2.978373e-05
      TP. H.C.M 243423 9.058004e-01  9.062557e-01
        TP. HCM    183 6.809606e-04  6.813029e-04
TP. HỒ CHÍ MINH     13 4.837425e-05  4.839857e-05
         TP.C.M     37 1.376806e-04  1.377498e-04
       TP.H.C.M  10293 3.830125e-02  3.832050e-02
         TP.HCM    629 2.340570e-03  2.341746e-03
 TP.Hồ Chí Minh     10 3.721096e-05  3.722967e-05
          TPHCM   8191 3.047950e-02  3.049482e-02
        TT- Huế     13 4.837425e-05  4.839857e-05
      Thanh Hóa      9 3.348987e-05  3.350670e-05
      Thái Bình      3 1.116329e-05  1.116890e-05
    Thái Nguyên      1 3.721096e-06  3.722967e-06
     Tiền Giang    171 6.363075e-04  6.366273e-04
         Tp HCM      3 1.116329e-05  1.116890e-05
         Tp.HCM     18 6.697973e-05  6.701340e-05
          TpHCM      3 1.116329e-05  1.116890e-05
          TpHcm     37 1.376806e-04  1.377498e-04
      TpP.H.C.M     15 5.581645e-05  5.584450e-05
```

```
            Trà Vinh     38 1.414017e-04  1.414727e-04
            Tây Ninh     71 2.641978e-04  2.643306e-04
           Vĩnh Long     66 2.455924e-04  2.457158e-04
             Đà Nẵng     13 4.837425e-05  4.839857e-05
             Đắk Lắk     48 1.786126e-04  1.787024e-04
            Đắk Nông     33 1.227962e-04  1.228579e-04
            Đồng Nai    327 1.216799e-03  1.217410e-03
           Đồng Tháp    175 6.511919e-04  6.515192e-04
                <NA>    135 5.023480e-04            NA
```

Filter based on reporting province

```
s2_2017_2022 <- s1_2017_2022 %>%
  mutate(
    cleaned_tinh_bao_cao = tolower(tinh_bao_cao) %>%
      stri_trans_general(id = "Latin-ASCII") %>%
      str_replace_all("[. -]", "")
  ) %>%
  filter(cleaned_tinh_bao_cao %in% c(
    "benhviennhidong1", "benhviennhidong2", "benhvienquan4", "bvansinh",
    "hcm", "hochiminh", "tpcm", "tphcm", "tphochiminh", "tpphcm"
  ) | is.na(cleaned_tinh_bao_cao))

s2_2017_2022 %>% tabyl(cleaned_tinh_bao_cao)
```

```
cleaned_tinh_bao_cao      n      percent valid_percent
    benhviennhidong1    192 7.292173e-04  7.295914e-04
    benhviennhidong2     60 2.278804e-04  2.279973e-04
       benhvienquan4     10 3.798007e-05  3.799955e-05
            bvansinh      6 2.278804e-05  2.279973e-05
                 hcm     12 4.557608e-05  4.559946e-05
           hochiminh     16 6.076811e-05  6.079928e-05
                tpcm     37 1.405263e-04  1.405983e-04
               tphcm 262782 9.980478e-01  9.985598e-01
         tphochiminh     31 1.177382e-04  1.177986e-04
              tpphcm     15 5.697010e-05  5.699933e-05
                <NA>    135 5.127309e-04            NA
```

```
s2_2017_2022 %>% skim()
```

Table 22: Data summary

Name	Piped data
Number of rows	263296
Number of columns	10
Column type frequency:	
character	8
numeric	1
POSIXct	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
gioi	0	1.00	2	3	0	11	0
quan_huyen_noi_o	0	1.00	6	16	0	25	0
phuong_xa_noi_o	0	1.00	8	23	0	181	0
don_vi_bao_cao	1	1.00	4	56	0	118	0
tinh_bao_cao	135	1.00	3	20	0	22	0
phan_do	197169	0.25	1	2	0	15	0
tinh_trang_hien_tai	46	1.00	2	170	0	174	0
cleaned_tinh_bao_cao	135	1.00	3	16	0	10	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
tuoi	39	1	22.41	27.34	-7974	11	20	31	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ngay_nhap_vien	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Filter based on reporting hospital

```r
s2_2017_2022 %>% tabyl(don_vi_bao_cao)
```

```
                                          don_vi_bao_cao     n      percent
                          Bệnh viện Bệnh nhiệt đới TPHCM 72139 2.739844e-01
                                     Bệnh viện Pháp Việt    10 3.798007e-05
                             Bệnh Viện Columbia Gia Định    10 3.798007e-05
                                      Bệnh Viện Hoàn Hảo     1 3.798007e-06
                                     Bệnh Viện Đức Khang    50 1.899003e-04
                                           Bệnh viện 175    19 7.216213e-05
                                       Bệnh viện An Bình   281 1.067240e-03
                                       Bệnh viện An Sinh   353 1.340696e-03
                                       Bệnh viện Chợ Rẫy   502 1.906599e-03
                                 Bệnh viện Gaya Việt Hàn    76 2.886485e-04
                                    Bệnh viện Gia An 115   231 8.773396e-04
                                       Bệnh viện Hoàn Mỹ  8037 3.052458e-02
                              Bệnh viện Huyện Bình Chánh  1700 6.456612e-03
                                 Bệnh viện Huyện Cần Giờ   833 3.163740e-03
                                  Bệnh viện Huyện Củ Chi  1141 4.333526e-03
                                  Bệnh viện Huyện Nhà Bè  1728 6.562956e-03
                                  Bệnh viện Hồng Đức III  1387 5.267835e-03
                        Bệnh viện Lê Lợi - Bà Rịa-V.Tàu     1 3.798007e-06
                                      Bệnh viện Minh Anh    33 1.253342e-04
                                        Bệnh viện Mỹ Đức   545 2.069914e-03
                              Bệnh viện Mỹ Đức Phú Nhuận     3 1.139402e-05
                             Bệnh viện Nguyễn Tri Phương   576 2.187652e-03
                                   Bệnh viện Nguyễn Trãi   693 2.632019e-03
                                    Bệnh viện Nhi Đồng 1    20 7.596014e-05
                                    Bệnh viện Nhi đồng 1 21078 8.005439e-02
                                    Bệnh viện Nhi đồng 2 21522 8.174070e-02
                            Bệnh viện Nhi đồng thành phố  5416 2.057000e-02
                                  Bệnh viện Nhân Dân 115  1122 4.261364e-03
                             Bệnh viện Nhân Dân Gia Định   471 1.788861e-03
                             Bệnh viện Nhân dân Gia Định     4 1.519203e-05
                                     Bệnh viện Pháp Việt  1855 7.045303e-03
                                Bệnh viện Phụ sản MêKông    26 9.874818e-05
Bệnh viện Phục hồi chức năng - Điều trị Bệnh nghề nghiệp    18 6.836412e-05
                          Bệnh viện Quân dân Y Miền Đông  1441 5.472928e-03
                                        Bệnh viện Quận 1  3552 1.349052e-02
                                       Bệnh viện Quận 10   419 1.591365e-03
                                       Bệnh viện Quận 11  3623 1.376018e-02
                                       Bệnh viện Quận 12 10260 3.896755e-02
                                        Bệnh viện Quận 2  1583 6.012245e-03
```

```
                     Bệnh viện Quận 3   609 2.312986e-03
                     Bệnh viện Quận 4  1498 5.689414e-03
                     Bệnh viện Quận 5   474 1.800255e-03
                     Bệnh viện Quận 6  1202 4.565204e-03
                     Bệnh viện Quận 7  1402 5.324806e-03
                     Bệnh viện Quận 8  1090 4.139827e-03
                     Bệnh viện Quận 9   909 3.452388e-03
            Bệnh viện Quận Bình Thạnh 10482 3.981071e-02
              Bệnh viện Quận Bình Tân  8322 3.160701e-02
                Bệnh viện Quận Gò Vấp  1582 6.008447e-03
             Bệnh viện Quận Phú Nhuận  1041 3.953725e-03
               Bệnh viện Quận Thủ Đức  3276 1.244227e-02
              Bệnh viện Quận Tân Bình  5610 2.130682e-02
               Bệnh viện Quận Tân Phú 26189 9.946600e-02
                 Bệnh viện Quốc Tế Mỹ   257 9.760877e-04
            Bệnh viện Quốc tế Becamex     2 7.596014e-06
               Bệnh viện Quốc tế City   488 1.853427e-03
                   Bệnh viện Quốc Ánh   808 3.068789e-03
                 Bệnh viện Thống Nhất  1530 5.810950e-03
                   Bệnh viện Triều An   514 1.952175e-03
                Bệnh viện Trưng Vương  4398 1.670363e-02
            Bệnh viện Tâm Trí Sài Gòn   665 2.525675e-03
                   Bệnh viện Tân Hưng   472 1.792659e-03
                      Bệnh viện Từ Dũ    31 1.177382e-04
                     Bệnh viện Vinmec   190 7.216213e-04
                   Bệnh viện Vạn Hạnh    38 1.443243e-04
                    Bệnh viện Xuyên Á  3799 1.442863e-02
           Bệnh viện huyện Bình Chánh    11 4.177807e-05
               Bệnh viện huyện Củ Chi     5 1.899003e-05
              Bệnh viện quận Bình Tân    37 1.405263e-04
              Bệnh viện quận Tân Bình    14 5.317210e-05
                Bệnh viện ĐKKV Củ Chi  7486 2.843188e-02
               Bệnh viện ĐKKV Hóc Môn  6654 2.527194e-02
               Bệnh viện ĐKKV Thủ Đức  4873 1.850769e-02
           Bệnh viện ĐKQT Nam Sài Gòn    15 5.697010e-05
       Bệnh viện Đa khoa Bưu Điện-CS1   540 2.050924e-03
       Bệnh viện Đa khoa Bưu Điện-CS3     1 3.798007e-06
     Bệnh viện Đa khoa Hòan Hảo (Cs2)     2 7.596014e-06
Bệnh viện Đa khoa Quốc tế Nam Sài Gòn     1 3.798007e-06
            Bệnh viện Đa khoa Sài Gòn     6 2.278804e-05
            Bệnh viện Đa khoa Tâm Anh  1295 4.918419e-03
  Bệnh viện Đa khoa khu vực Hậu Nghĩa     1 3.798007e-06
       Bệnh viện Đại học Y Dược TPHCM   702 2.666201e-03
```

```
                            Bệnh viện đa khoa 30/4 Tp.HCM   713 2.707979e-03
               Bệnh viện đa khoa Quốc Tế Hoàn Mỹ Thủ Đức    93 3.532146e-04
                                Bệnh viện đa khoa Sài Gòn   479 1.819245e-03
                         Bệnh viện đa khoa quốc tế Vũ Anh   438 1.663527e-03
                        Bệnh viện đa khoa tỉnh Bình Dương     1 3.798007e-06
                           Bệnh viện đa khoa tỉnh Đắk Lắk     1 3.798007e-06
                                                     HCDC     1 3.798007e-06
                                            PK THANH CONG    21 7.975814e-05
                                 PKĐK Phước Lợi - Long An     1 3.798007e-06
                       Phòng khám đa khoa Trần Diệp Khanh    87 3.304266e-04
                                   TTYT Thị xã Trảng Bàng     1 3.798007e-06
             Trung tâm Kiểm soát bệnh tật Tp.Hồ Chí Minh     2 7.596014e-06
                          Trung tâm Y tế  Huyện Vĩnh Hưng     2 7.596014e-06
                          Trung tâm Y tế  Huyện Xuyên Mộc     1 3.798007e-06
                                   Trung tâm Y tế  Quận 1     1 3.798007e-06
                                   Trung tâm Y tế  Quận 3     1 3.798007e-06
                                   Trung tâm Y tế  Quận 9   112 4.253768e-04
                          Trung tâm Y tế  Quận Bình Thạnh     5 1.899003e-05
                            Trung tâm Y tế  Quận Bình Tân     1 3.798007e-06
                           Trung tâm Y tế  Quận Phú Nhuận     2 7.596014e-06
                     Trung tâm kiểm soát bệnh tật Long An     1 3.798007e-06
               Trung tâm kiểm soát bệnh tật Thành phố HCM     1 3.798007e-06
                        Trung tâm y tế Dự phòng TP. H.C.M     1 3.798007e-06
                             Trung tâm y tế tỉnh Trà Vinh     1 3.798007e-06
                                Trạm Y tế  Phuoc Tan Hung     2 7.596014e-06
                                     Trạm Y tế  Phường 03     1 3.798007e-06
                            Trạm Y tế  Phường An Lợi Đông     2 7.596014e-06
                                 Trạm Y tế  Phường An Phú     5 1.899003e-05
                                Trạm Y tế  Phường Bình An     2 7.596014e-06
                             Trạm Y tế  Phường Bình Khánh     1 3.798007e-06
                        Trạm Y tế  Phường Bình Trưng Đông     3 1.139402e-05
                                Trạm Y tế  Phường Cát Lái     1 3.798007e-06
                                    Trạm Y tế xã Hiệp Hòa     1 3.798007e-06
                                 Trạm y tế Bình Trưng Tây     3 1.139402e-05
                                           Viện Tim TPHCM     3 1.139402e-05
                                    bv.nd2.khth@gmail.com    24 9.115216e-05
                                                     <NA>     1 3.798007e-06

valid_percent
 2.739855e-01
 3.798021e-05
 3.798021e-05
 3.798021e-06
 1.899011e-04
```

```
7.216240e-05
1.067244e-03
1.340701e-03
1.906607e-03
2.886496e-04
8.773429e-04
3.052470e-02
6.456636e-03
3.163752e-03
4.333542e-03
6.562981e-03
5.267855e-03
3.798021e-06
1.253347e-04
2.069922e-03
1.139406e-05
2.187660e-03
2.632029e-03
7.596042e-05
8.005469e-02
8.174101e-02
2.057008e-02
4.261380e-03
1.788868e-03
1.519208e-05
7.045329e-03
9.874855e-05
6.836438e-05
5.472949e-03
1.349057e-02
1.591371e-03
1.376023e-02
3.896770e-02
6.012268e-03
2.312995e-03
5.689436e-03
1.800262e-03
4.565222e-03
5.324826e-03
4.139843e-03
3.452401e-03
3.981086e-02
3.160713e-02
```

```
6.008470e-03
3.953740e-03
1.244232e-02
2.130690e-02
9.946638e-02
9.760915e-04
7.596042e-06
1.853434e-03
3.068801e-03
5.810972e-03
1.952183e-03
1.670370e-02
2.525684e-03
1.792666e-03
1.177387e-04
7.216240e-04
1.443248e-04
1.442868e-02
4.177823e-05
1.899011e-05
1.405268e-04
5.317230e-05
2.843199e-02
2.527203e-02
1.850776e-02
5.697032e-05
2.050931e-03
3.798021e-06
7.596042e-06
3.798021e-06
2.278813e-05
4.918437e-03
3.798021e-06
2.666211e-03
2.707989e-03
3.532160e-04
1.819252e-03
1.663533e-03
3.798021e-06
3.798021e-06
3.798021e-06
7.975845e-05
3.798021e-06
```

```
  3.304278e-04
  3.798021e-06
  7.596042e-06
  7.596042e-06
  3.798021e-06
  3.798021e-06
  3.798021e-06
  4.253784e-04
  1.899011e-05
  3.798021e-06
  7.596042e-06
  3.798021e-06
  3.798021e-06
  3.798021e-06
  3.798021e-06
  7.596042e-06
  3.798021e-06
  7.596042e-06
  1.899011e-05
  7.596042e-06
  3.798021e-06
  1.139406e-05
  3.798021e-06
  3.798021e-06
  1.139406e-05
  1.139406e-05
  9.115251e-05
            NA
```

Manual cleaning based on an “eye test” and some quick Googling

```r
s2b_2017_2022 <- s2_2017_2022 %>% filter(!(
  don_vi_bao_cao %in% c("Bệnh viện Lê Lợi - Bà Rịa-V.Tàu", "Bệnh viện Quốc tế Becamex", "Bệnh
))
s2b_2017_2022 %>% skim()
```

Table 26: Data summary

Name	Piped data
Number of rows	263284
Number of columns	10

Column type frequency:	
character	8
numeric	1
POSIXct	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
gioi	0	1.00	2	3	0	11	0
quan_huyen_noi_o	0	1.00	6	16	0	25	0
phuong_xa_noi_o	0	1.00	8	23	0	181	0
don_vi_bao_cao	1	1.00	4	56	0	108	0
tinh_bao_cao	133	1.00	3	20	0	22	0
phan_do	197162	0.25	1	2	0	15	0
tinh_trang_hien_tai	46	1.00	2	170	0	174	0
cleaned_tinh_bao_cao	133	1.00	3	16	0	10	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
tuoi	39	1	22.41	27.34	-7974	11	20	31	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ngay_nhap_vien	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Filter out cases where the reporting hospital is null (only 1 case)

```
s2c_2017_2022 <- s2b_2017_2022 %>% drop_na(don_vi_bao_cao)
s2c_2017_2022 %>% skim()
```

Table 30: Data summary

Name	Piped data
Number of rows	263283
Number of columns	10
_______________________	
Column type frequency:	
character	8
numeric	1
POSIXct	1
________________________	
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
gioi	0	1.00	2	3	0	11	0
quan_huyen_noi_o	0	1.00	6	16	0	25	0
phuong_xa_noi_o	0	1.00	8	23	0	181	0
don_vi_bao_cao	0	1.00	4	56	0	108	0
tinh_bao_cao	132	1.00	3	20	0	22	0
phan_do	197162	0.25	1	2	0	15	0
tinh_trang_hien_tai	46	1.00	2	170	0	174	0
cleaned_tinh_bao_cao	132	1.00	3	16	0	10	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
tuoi	39	1	22.41	27.34	-7974	11	20	31	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
ngay_nhap_vien	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Wrapping this up

```
s3_2017_2022 <- s2c_2017_2022 %>% select(-tinh_bao_cao, -cleaned_tinh_bao_cao)
```

Rename columns

Let's rename columns before continuing

```
s4_2017_2022 <- s3_2017_2022 %>%
  rename(
    sex = gioi,
    age = tuoi,
    date = ngay_nhap_vien,
    district = quan_huyen_noi_o,
    commune = phuong_xa_noi_o,
    hospital = don_vi_bao_cao,
    icd = phan_do,
    in_out_patient = tinh_trang_hien_tai
  )

s4_2017_2022 %>% skim()
```

Table 34: Data summary

Name	Piped data
Number of rows	263283
Number of columns	8
Column type frequency:	
character	6
numeric	1
POSIXct	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	2	3	0	11	0
district	0	1.00	6	16	0	25	0
commune	0	1.00	8	23	0	181	0

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
hospital	0	1.00	4	56	0	108	0
icd	197162	0.25	1	2	0	15	0
in_out_patient	46	1.00	2	170	0	174	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	39	1	22.41	27.34	-7974	11	20	31	2021	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Fix age

We see the same problem with some negative age and YOB put in as age

```
s4_2017_2022 %>% tabyl(age)
```

```
   age    n      percent valid_percent
 -7974    1 3.798194e-06  3.798757e-06
 -7153    1 3.798194e-06  3.798757e-06
  -974    1 3.798194e-06  3.798757e-06
   -77    1 3.798194e-06  3.798757e-06
   -11    1 3.798194e-06  3.798757e-06
    -1    1 3.798194e-06  3.798757e-06
     0 1200 4.557833e-03  4.558508e-03
     1 7559 2.871055e-02  2.871480e-02
     2 4725 1.794647e-02  1.794913e-02
     3 4596 1.745650e-02  1.745909e-02
     4 4587 1.742232e-02  1.742490e-02
     5 5302 2.013803e-02  2.014101e-02
     6 6846 2.600244e-02  2.600629e-02
     7 7291 2.769263e-02  2.769674e-02
     8 7340 2.787875e-02  2.788288e-02
     9 7233 2.747234e-02  2.747641e-02
    10 8268 3.140347e-02  3.140812e-02
    11 8172 3.103884e-02  3.104344e-02
    12 7587 2.881690e-02  2.882117e-02
    13 8120 3.084134e-02  3.084591e-02
    14 7867 2.988039e-02  2.988482e-02
    15 7156 2.717988e-02  2.718391e-02
    16 6091 2.313480e-02  2.313823e-02
    17 5395 2.049126e-02  2.049429e-02
    18 5804 2.204472e-02  2.204799e-02
    19 6525 2.478322e-02  2.478689e-02
    20 5904 2.242454e-02  2.242786e-02
    21 5779 2.194977e-02  2.195302e-02
    22 5970 2.267522e-02  2.267858e-02
    23 5908 2.243973e-02  2.244306e-02
    24 5863 2.226881e-02  2.227211e-02
    25 6210 2.358679e-02  2.359028e-02
    26 6100 2.316899e-02  2.317242e-02
    27 6205 2.356780e-02  2.357129e-02
    28 5859 2.225362e-02  2.225692e-02
    29 5775 2.193457e-02  2.193782e-02
    30 5381 2.043808e-02  2.044111e-02
    31 5021 1.907073e-02  1.907356e-02
    32 4856 1.844403e-02  1.844676e-02
    33 4565 1.733876e-02  1.734133e-02
    34 4414 1.676523e-02  1.676771e-02
    35 4188 1.590684e-02  1.590919e-02
    36 3797 1.442174e-02  1.442388e-02
    37 3621 1.375326e-02  1.375530e-02
    38 3271 1.242389e-02  1.242573e-02
    39 3155 1.198330e-02  1.198508e-02
    40 2798 1.062735e-02  1.062892e-02
    41 2515 9.552459e-03  9.553874e-03
    42 2305 8.754838e-03  8.756135e-03
    43 2138 8.120539e-03  8.121743e-03
    44 1993 7.569801e-03  7.570923e-03
    45 1760 6.684822e-03  6.685812e-03
    46 1705 6.475921e-03  6.476881e-03
    47 1503 5.708686e-03  5.709532e-03
    48 1355 5.146553e-03  5.147316e-03
    49 1277 4.850294e-03  4.851013e-03
    50 1169 4.440089e-03  4.440747e-03
    51 1083 4.113444e-03  4.114054e-03
```

```
52  991 3.764011e-03  3.764568e-03
53  955 3.627276e-03  3.627813e-03
54  887 3.368998e-03  3.369498e-03
55  802 3.046152e-03  3.046603e-03
56  754 2.863839e-03  2.864263e-03
57  765 2.905619e-03  2.906049e-03
58  693 2.632149e-03  2.632539e-03
59  607 2.305504e-03  2.305846e-03
60  608 2.309302e-03  2.309644e-03
61  541 2.054823e-03  2.055128e-03
62  527 2.001648e-03  2.001945e-03
63  455 1.728178e-03  1.728434e-03
64  432 1.640820e-03  1.641063e-03
65  345 1.310377e-03  1.310571e-03
66  350 1.329368e-03  1.329565e-03
67  279 1.059696e-03  1.059853e-03
68  279 1.059696e-03  1.059853e-03
69  224 8.507955e-04  8.509216e-04
70  197 7.482443e-04  7.483551e-04
71  162 6.153075e-04  6.153986e-04
72  136 5.165544e-04  5.166310e-04
73  137 5.203526e-04  5.204297e-04
74  119 4.519851e-04  4.520521e-04
75  108 4.102050e-04  4.102658e-04
76   87 3.304429e-04  3.304919e-04
77   75 2.848646e-04  2.849068e-04
78   65 2.468826e-04  2.469192e-04
79   63 2.392862e-04  2.393217e-04
80   55 2.089007e-04  2.089316e-04
81   63 2.392862e-04  2.393217e-04
82   52 1.975061e-04  1.975354e-04
83   36 1.367350e-04  1.367553e-04
84   28 1.063494e-04  1.063652e-04
85   31 1.177440e-04  1.177615e-04
86   27 1.025512e-04  1.025664e-04
87   22 8.356028e-05  8.357266e-05
88   26 9.875305e-05  9.876768e-05
89   24 9.115666e-05  9.117017e-05
90   17 6.456930e-05  6.457887e-05
91    8 3.038555e-05  3.039006e-05
92   12 4.557833e-05  4.558508e-05
93    3 1.139458e-05  1.139627e-05
94    6 2.278917e-05  2.279254e-05
```

```
    95    3 1.139458e-05  1.139627e-05
    96    4 1.519278e-05  1.519503e-05
    98    2 7.596389e-06  7.597514e-06
    99    1 3.798194e-06  3.798757e-06
   101    2 7.596389e-06  7.597514e-06
   110    1 3.798194e-06  3.798757e-06
   112    8 3.038555e-05  3.039006e-05
   113    3 1.139458e-05  1.139627e-05
   114    6 2.278917e-05  2.279254e-05
   117    3 1.139458e-05  1.139627e-05
   122    4 1.519278e-05  1.519503e-05
   147    1 3.798194e-06  3.798757e-06
   195    1 3.798194e-06  3.798757e-06
   197    2 7.596389e-06  7.597514e-06
   198    6 2.278917e-05  2.279254e-05
   199    4 1.519278e-05  1.519503e-05
   200    1 3.798194e-06  3.798757e-06
   223    1 3.798194e-06  3.798757e-06
   232    2 7.596389e-06  7.597514e-06
   345    1 3.798194e-06  3.798757e-06
   427    1 3.798194e-06  3.798757e-06
   440    1 3.798194e-06  3.798757e-06
   551    1 3.798194e-06  3.798757e-06
   819    1 3.798194e-06  3.798757e-06
   820    1 3.798194e-06  3.798757e-06
   821    4 1.519278e-05  1.519503e-05
   822    2 7.596389e-06  7.597514e-06
   823    1 3.798194e-06  3.798757e-06
   824    2 7.596389e-06  7.597514e-06
   825    2 7.596389e-06  7.597514e-06
   925    1 3.798194e-06  3.798757e-06
  1010    1 3.798194e-06  3.798757e-06
  1013    1 3.798194e-06  3.798757e-06
  1038    1 3.798194e-06  3.798757e-06
  2013    1 3.798194e-06  3.798757e-06
  2021    1 3.798194e-06  3.798757e-06
    NA   39 1.481296e-04            NA
```

```r
s5_2017_2022 <- s4_2017_2022 %>%
  mutate(age = if_else(age > 2000, year(date) - age, age)) %>%
  filter(age >= 0, age < 91)
```

```r
s5_2017_2022 %>% tabyl(age)
```

```
 age    n      percent
   0 1200 4.560431e-03
   1 7560 2.873072e-02
   2 4725 1.795670e-02
   3 4596 1.746645e-02
   4 4587 1.743225e-02
   5 5302 2.014951e-02
   6 6846 2.601726e-02
   7 7291 2.770842e-02
   8 7340 2.789464e-02
   9 7234 2.749180e-02
  10 8268 3.142137e-02
  11 8172 3.105654e-02
  12 7587 2.883333e-02
  13 8120 3.085892e-02
  14 7867 2.989743e-02
  15 7156 2.719537e-02
  16 6091 2.314799e-02
  17 5395 2.050294e-02
  18 5804 2.205729e-02
  19 6525 2.479735e-02
  20 5904 2.243732e-02
  21 5779 2.196228e-02
  22 5970 2.268815e-02
  23 5908 2.245252e-02
  24 5863 2.228151e-02
  25 6210 2.360023e-02
  26 6100 2.318219e-02
  27 6205 2.358123e-02
  28 5859 2.226631e-02
  29 5775 2.194708e-02
  30 5381 2.044973e-02
  31 5021 1.908161e-02
  32 4856 1.845455e-02
  33 4565 1.734864e-02
  34 4414 1.677479e-02
  35 4188 1.591591e-02
  36 3797 1.442997e-02
  37 3621 1.376110e-02
  38 3271 1.243098e-02
```

```
39 3155 1.199013e-02
40 2798 1.063341e-02
41 2515 9.557904e-03
42 2305 8.759829e-03
43 2138 8.125169e-03
44 1993 7.574117e-03
45 1760 6.688633e-03
46 1705 6.479613e-03
47 1503 5.711940e-03
48 1355 5.149487e-03
49 1277 4.853059e-03
50 1169 4.442620e-03
51 1083 4.115789e-03
52  991 3.766156e-03
53  955 3.629343e-03
54  887 3.370919e-03
55  802 3.047888e-03
56  754 2.865471e-03
57  765 2.907275e-03
58  693 2.633649e-03
59  607 2.306818e-03
60  608 2.310619e-03
61  541 2.055994e-03
62  527 2.002789e-03
63  455 1.729164e-03
64  432 1.641755e-03
65  345 1.311124e-03
66  350 1.330126e-03
67  279 1.060300e-03
68  279 1.060300e-03
69  224 8.512805e-04
70  197 7.486708e-04
71  162 6.156582e-04
72  136 5.168489e-04
73  137 5.206493e-04
74  119 4.522428e-04
75  108 4.104388e-04
76   87 3.306313e-04
77   75 2.850270e-04
78   65 2.470234e-04
79   63 2.394226e-04
80   55 2.090198e-04
81   63 2.394226e-04
```

```
  82    52 1.976187e-04
  83    36 1.368129e-04
  84    28 1.064101e-04
  85    31 1.178111e-04
  86    27 1.026097e-04
  87    22 8.360791e-05
  88    26 9.880935e-05
  89    24 9.120863e-05
  90    17 6.460611e-05
```

```
s5_2017_2022 %>% skim()
```

Table 38: Data summary

Name	Piped data
Number of rows	263133
Number of columns	8
Column type frequency:	
character	6
numeric	1
POSIXct	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	2	3	0	11	0
district	0	1.00	6	16	0	25	0
commune	0	1.00	8	23	0	181	0
hospital	0	1.00	4	56	0	108	0
icd	197058	0.25	1	2	0	15	0
in_out_patient	46	1.00	2	170	0	174	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	22.36	14.92	0	11	20	31	90	

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Fix dates

Date data is in `datetime`, convert to `date` only

```
s6_2017_2022 <- s5_2017_2022 %>%
  mutate(date = convert_to_date(date))

s6_2017_2022 %>% skim()
```

Table 42: Data summary

Name	Piped data
Number of rows	263133
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	2	3	0	11	0
district	0	1.00	6	16	0	25	0
commune	0	1.00	8	23	0	181	0
hospital	0	1.00	4	56	0	108	0
icd	197058	0.25	1	2	0	15	0
in_out_patient	46	1.00	2	170	0	174	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	22.36	14.92	0	11	20	31	90	

Fix ICD

```
s6_2017_2022 %>%
  mutate(year = year(date)) %>%
  tabyl(icd, year)
```

```
  icd  2017  2018  2019  2020 2021  2022
    1    42    12     0     0    0     1
    2     5     2     0     0    0     0
   2a     9     5     7     0    1     0
   2A     0     0     1     0    0     0
   2b     0     0     0     0    0     1
    a  2871  7541 12942  5555 3230 18625
    A     0    48    23     0    0     2
    b   689   569   624   575  524  9359
    B     0    12    26     1    0     7
    c   260   129   111    95   93  2042
    C     0     1     1     7    0     6
   c1     0    18     0     0    0     0
   c2     0     1     0     0    0     0
   C2     0     1     0     0    0     0
    v     0     0     1     0    0     0
 <NA> 29297 36673 53135 19190 8603 50160
```

Mostly inconsistent letter casing, the classes are rather consistent

```
s7_2017_2022 <- s6_2017_2022 %>%
  mutate(icd = tolower(icd))
```

```
s7_2017_2022 %>%
  mutate(year = year(date)) %>%
  tabyl(icd, year)
```

```
  icd  2017  2018  2019  2020 2021  2022
    1    42    12     0     0    0     1
    2     5     2     0     0    0     0
   2a     9     5     8     0    1     0
   2b     0     0     0     0    0     1
    a  2871  7589 12965  5555 3230 18627
    b   689   581   650   576  524  9366
    c   260   130   112   102   93  2048
   c1     0    18     0     0    0     0
   c2     0     2     0     0    0     0
    v     0     0     1     0    0     0
 <NA> 29297 36673 53135 19190 8603 50160
```

Fix sexes

```
s7_2017_2022 %>% tabyl(sex)
```

```
 sex      n      percent
 NAM   1171 4.450221e-03
 NAm      2 7.600719e-06
  NU      2 7.600719e-06
 Nam 141773 5.387884e-01
  Nữ     62 2.356223e-04
  NỮ   1092 4.149993e-03
  Nữ 118434 4.500918e-01
 nAM      1 3.800360e-06
 nam    304 1.155309e-03
  nỮ      3 1.140108e-05
  nữ    289 1.098304e-03
```

Very easy fix, just remove diacritics, normalise letter casing and recode into english

```r
s8_2017_2022 <- s7_2017_2022 %>%
  mutate(sex = stri_trans_general(sex, id = "Latin-ASCII") %>% tolower()) %>%
  mutate(sex = case_when(sex == "nam" ~ "male", sex == "nu" ~ "female"))

s8_2017_2022 %>% tabyl(sex)
```

```
    sex      n   percent
 female 119882 0.4555947
   male 143251 0.5444053
```

```r
s8_2017_2022 %>% skim()
```

Table 46: Data summary

Name	Piped data
Number of rows	263133
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	4	6	0	2	0
district	0	1.00	6	16	0	25	0
commune	0	1.00	8	23	0	181	0
hospital	0	1.00	4	56	0	108	0
icd	197058	0.25	1	2	0	10	0
in_out_patient	46	1.00	2	170	0	174	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	22.36	14.92	0	11	20	31	90	

See that there are 25 districts, instead of 24, let's see what's wrong

```
s8_2017_2022 %>% tabyl(district)
```

```
         district     n      percent
 Huyện Bình Chánh 22955 0.0872372526
    Huyện Cần Giờ  1754 0.0066658306
     Huyện Củ Chi 12295 0.0467254202
    Huyện Hóc Môn 15597 0.0592742073
     Huyện Nhà Bè  5739 0.0218102633
           Quận 1  6923 0.0263098889
          Quận 10  5559 0.0211261985
          Quận 11  6063 0.0230415797
          Quận 12 19205 0.0729859045
           Quận 2  4867 0.0184963498
           Quận 3  5392 0.0204915385
           Quận 4  4625 0.0175766628
           Quận 5  4543 0.0172650333
           Quận 6  6563 0.0249417595
           Quận 7  9305 0.0353623453
           Quận 8 12411 0.0471662619
           Quận 9  9321 0.0354231510
  Quận Bình Thạnh 14128 0.0536914792
    Quận Bình Tân 31456 0.1195441089
      Quận Gò Vấp    52 0.0001976187
      Quận Gò vấp  9854 0.0374487427
   Quận Phú Nhuận  4428 0.0168279919
     Quận Thủ Đức 12428 0.0472308680
    Quận Tân Bình 15722 0.0597492523
     Quận Tân Phú 21948 0.0834102906
```

Just letter casing issue, let's normalise that

Fix districts

```
s9_2017_2022 <- s8_2017_2022 %>% mutate(district = tolower(district))

s9_2017_2022 %>% skim()
```

Table 50: Data summary

Name	Piped data
Number of rows	263133
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	4	6	0	2	0
district	0	1.00	6	16	0	24	0
commune	0	1.00	8	23	0	181	0
hospital	0	1.00	4	56	0	108	0
icd	197058	0.25	1	2	0	10	0
in_out_patient	46	1.00	2	170	0	174	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	22.36	14.92	0	11	20	31	90	

Fix in-/out-patient

Now let's do the hardest part, fixing in-patient and out-patient classification

```
s9_2017_2022 %>% tabyl(in_out_patient)
```

Nặng xin về ngày 29/08/2022 tại Hậu phẫu phòng mổ. Sốc mất máu; Rối loạn đông máu không đặc

Đang điều trị xin về ng

```
 n      percent valid_percent
20 7.600719e-05  7.602048e-05
 9 3.420324e-05  3.420922e-05
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 4 1.520144e-05  1.520410e-05
 1 3.800360e-06  3.801024e-06
10 3.800360e-05  3.801024e-05
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 4 1.520144e-05  1.520410e-05
 2 7.600719e-06  7.602048e-06
 1 3.800360e-06  3.801024e-06
 6 2.280216e-05  2.280614e-05
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 1 3.800360e-06  3.801024e-06
 4 1.520144e-05  1.520410e-05
 1 3.800360e-06  3.801024e-06
```

```
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
  47 1.786169e-04  1.786481e-04
   1 3.800360e-06  3.801024e-06
 581 2.208009e-03  2.208395e-03
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   7 2.660252e-05  2.660717e-05
 129 4.902464e-04  4.903321e-04
   2 7.600719e-06  7.602048e-06
   1 3.800360e-06  3.801024e-06
   4 1.520144e-05  1.520410e-05
   7 2.660252e-05  2.660717e-05
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
  37 1.406133e-04  1.406379e-04
   1 3.800360e-06  3.801024e-06
  26 9.880935e-05  9.882662e-05
  11 4.180395e-05  4.181126e-05
   1 3.800360e-06  3.801024e-06
1014 3.853565e-03  3.854238e-03
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
 318 1.208514e-03  1.208726e-03
   2 7.600719e-06  7.602048e-06
   1 3.800360e-06  3.801024e-06
  14 5.320503e-05  5.321434e-05
   3 1.140108e-05  1.140307e-05
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
   1 3.800360e-06  3.801024e-06
 174 6.612626e-04  6.613782e-04
   8 3.040288e-05  3.040819e-05
 196 7.448705e-04  7.450007e-04
   7 2.660252e-05  2.660717e-05
  10 3.800360e-05  3.801024e-05
```

```
   54 2.052194e-04  2.052553e-04
    5 1.900180e-05  1.900512e-05
36794 1.398304e-01  1.398549e-01
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    5 1.900180e-05  1.900512e-05
    1 3.800360e-06  3.801024e-06
    2 7.600719e-06  7.602048e-06
   13 4.940467e-05  4.941331e-05
    1 3.800360e-06  3.801024e-06
   35 1.330126e-04  1.330358e-04
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    2 7.600719e-06  7.602048e-06
    3 1.140108e-05  1.140307e-05
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
   14 5.320503e-05  5.321434e-05
    3 1.140108e-05  1.140307e-05
   20 7.600719e-05  7.602048e-05
    3 1.140108e-05  1.140307e-05
    1 3.800360e-06  3.801024e-06
   68 2.584244e-04  2.584696e-04
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
   46 1.748165e-04  1.748471e-04
    6 2.280216e-05  2.280614e-05
  159 6.042572e-04  6.043628e-04
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    3 1.140108e-05  1.140307e-05
    70 2.660252e-04  2.660717e-04
     1 3.800360e-06  3.801024e-06
     2 7.600719e-06  7.602048e-06
    10 3.800360e-05  3.801024e-05
     3 1.140108e-05  1.140307e-05
    15 5.700539e-05  5.701536e-05
     4 1.520144e-05  1.520410e-05
     2 7.600719e-06  7.602048e-06
     1 3.800360e-06  3.801024e-06
    95 3.610342e-04  3.610973e-04
     2 7.600719e-06  7.602048e-06
   275 1.045099e-03  1.045282e-03
    78 2.964280e-04  2.964799e-04
     1 3.800360e-06  3.801024e-06
     2 7.600719e-06  7.602048e-06
     1 3.800360e-06  3.801024e-06
    15 5.700539e-05  5.701536e-05
     1 3.800360e-06  3.801024e-06
     1 3.800360e-06  3.801024e-06
     3 1.140108e-05  1.140307e-05
     2 7.600719e-06  7.602048e-06
     1 3.800360e-06  3.801024e-06
    46 1.748165e-04  1.748471e-04
  2390 9.082859e-03  9.084447e-03
     1 3.800360e-06  3.801024e-06
     4 1.520144e-05  1.520410e-05
     2 7.600719e-06  7.602048e-06
     1 3.800360e-06  3.801024e-06
     2 7.600719e-06  7.602048e-06
    12 4.560431e-05  4.561229e-05
    19 7.220683e-05  7.221946e-05
     5 1.900180e-05  1.900512e-05
    11 4.180395e-05  4.181126e-05
    12 4.560431e-05  4.561229e-05
    10 3.800360e-05  3.801024e-05
119151 4.528166e-01  4.528958e-01
     1 3.800360e-06  3.801024e-06
     1 3.800360e-06  3.801024e-06
     1 3.800360e-06  3.801024e-06
     1 3.800360e-06  3.801024e-06
     1 3.800360e-06  3.801024e-06
     2 7.600719e-06  7.602048e-06
     8 3.040288e-05  3.040819e-05
```

```
      1 3.800360e-06  3.801024e-06
 100584 3.822554e-01  3.823222e-01
      1 3.800360e-06  3.801024e-06
      8 3.040288e-05  3.040819e-05
      4 1.520144e-05  1.520410e-05
      1 3.800360e-06  3.801024e-06
      5 1.900180e-05  1.900512e-05
     60 2.280216e-04  2.280614e-04
     43 1.634155e-04  1.634440e-04
      3 1.140108e-05  1.140307e-05
      1 3.800360e-06  3.801024e-06
      1 3.800360e-06  3.801024e-06
      1 3.800360e-06  3.801024e-06
      2 7.600719e-06  7.602048e-06
      2 7.600719e-06  7.602048e-06
     84 3.192302e-04  3.192860e-04
      1 3.800360e-06  3.801024e-06
     59 2.242212e-04  2.242604e-04
      3 1.140108e-05  1.140307e-05
     46 1.748165e-04            NA
```

Simplest things to do now are remove diacritics, normalise casing, normaling spacing

```
s9b_2017_2022 <- s9_2017_2022 %>% mutate(
  in_out_patient = stri_trans_general(in_out_patient, id = "Latin-ASCII") %>% tolower()
)

s9b_2017_2022 %>%
  tabyl(in_out_patient) %>%
  arrange(desc(n))
```

dang dieu tri xin ve ng

```
nang xin ve ngay 29/08/2022 tai hau phau phong mo. soc mat mau; roi loan dong mau khong dac
```

```
     n      percent valid_percent
121979 4.635641e-01  4.636451e-01
100865 3.833233e-01  3.833903e-01
 36878 1.401497e-01  1.401742e-01
  1110 4.218399e-03  4.219137e-03
   588 2.234611e-03  2.235002e-03
   390 1.482140e-03  1.482399e-03
   331 1.257919e-03  1.258139e-03
   329 1.250318e-03  1.250537e-03
   129 4.902464e-04  4.903321e-04
    85 3.230306e-04  3.230870e-04
    47 1.786169e-04  1.786481e-04
    46 1.748165e-04            NA
    37 1.406133e-04  1.406379e-04
    35 1.330126e-04  1.330358e-04
    20 7.600719e-05  7.602048e-05
    15 5.700539e-05  5.701536e-05
    14 5.320503e-05  5.321434e-05
    14 5.320503e-05  5.321434e-05
    13 4.940467e-05  4.941331e-05
    12 4.560431e-05  4.561229e-05
    10 3.800360e-05  3.801024e-05
```

```
9 3.420324e-05  3.420922e-05
9 3.420324e-05  3.420922e-05
8 3.040288e-05  3.040819e-05
8 3.040288e-05  3.040819e-05
7 2.660252e-05  2.660717e-05
7 2.660252e-05  2.660717e-05
7 2.660252e-05  2.660717e-05
6 2.280216e-05  2.280614e-05
5 1.900180e-05  1.900512e-05
5 1.900180e-05  1.900512e-05
4 1.520144e-05  1.520410e-05
4 1.520144e-05  1.520410e-05
4 1.520144e-05  1.520410e-05
3 1.140108e-05  1.140307e-05
3 1.140108e-05  1.140307e-05
3 1.140108e-05  1.140307e-05
3 1.140108e-05  1.140307e-05
3 1.140108e-05  1.140307e-05
3 1.140108e-05  1.140307e-05
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
2 7.600719e-06  7.602048e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
```

```
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
1 3.800360e-06  3.801024e-06
```

```
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
    1 3.800360e-06  3.801024e-06
```

Lots of random stuff, but major are the in-, out-patient labels and some others (e.g. referred, discharged). The only way to fix this seems to be by hand with regex

```
s10_2017_2022 <- s9b_2017_2022 %>%
  mutate(
    in_out_patient = case_when(
      str_detect(in_out_patient, "(dieu tri)?.*n?g[opa]{2}[ij]{1,2}.*tr?u") ~ "out-patient",
      str_detect(in_out_patient, "((di?eu t[tr][ij]{1})?.*no[it]{1}.*tr?[ui])|(n{1,2}hap vie
      str_detect(in_out_patient, "((ra|xuat|tron|bo).*vien)|((xin|bo|cho).*(ve|xv))|(ve nha)
      str_detect(in_out_patient, "chuyen.*(benh|bv|vie[nb]|tuyen|khoa)") ~ "referred",
      .default = "miscellanous"
    )
  )
```

This is as best as I can do...

```
s10_2017_2022 %>%
  tabyl(in_out_patient)
```

```
 in_out_patient      n     percent
     discharged  37485 0.142456476
     in-patient 101655 0.386325546
   miscellanous    264 0.001003295
    out-patient 123112 0.467869860
       referred    617 0.002344822
```

```
s10_2017_2022 %>% skim()
```

Table 54: Data summary

Name	Piped data
Number of rows	263133
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	0	1.00	4	6	0	2	0
district	0	1.00	6	16	0	24	0
commune	0	1.00	8	23	0	181	0
hospital	0	1.00	4	56	0	108	0
icd	197058	0.25	1	2	0	10	0
in_out_patient	0	1.00	8	12	0	5	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2017-01-01	2022-12-31	2019-10-26	2191

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	22.36	14.92	0	11	20	31	90	

Wrap up

Probably finished cleaning 2017-2022 data

Let’s check final number of rows

```
nrow(s10_2017_2022)
```

```
[1] 263133
```

```
start_nrow2 - nrow(s10_2017_2022)
```

```
[1] 5605
```

```
(start_nrow2 - nrow(s10_2017_2022)) / start_nrow2 * 100
```

```
[1] 2.085675
```

Lost about 2% of rows

Data joining

Join the 2 data tibles

```
cleaned_incidence_dat <- s4_2000_2016 %>% bind_rows(s10_2017_2022)

cleaned_incidence_dat %>% skim()
```

Table 58: Data summary

Name	Piped data
Number of rows	388929
Number of columns	8
Column type frequency:	
character	6
Date	1
numeric	1
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
sex	2774	0.99	1	6	0	9	0
district	0	1.00	2	16	0	48	0
commune	0	1.00	2	23	0	352	0
hospital	0	1.00	4	56	0	145	0
icd	202338	0.48	1	6	0	45	0
in_out_patient	0	1.00	8	12	0	5	0

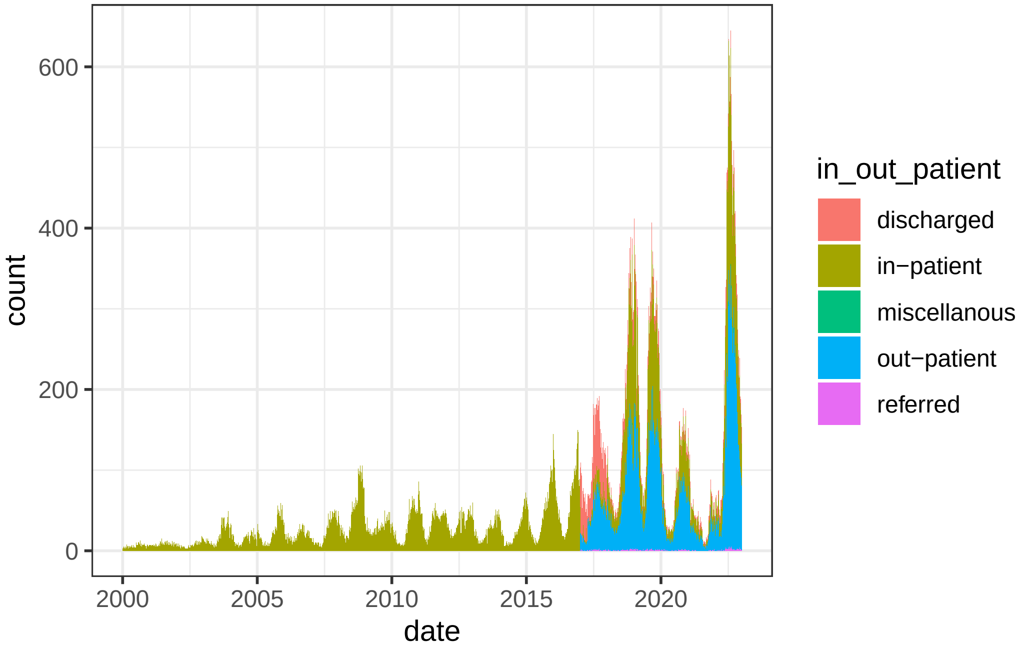
Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2000-01-01	2022-12-31	2018-11-23	8319

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
age	0	1	20.29	14.27	0	9	17	29	90	

```r
cleaned_incidence_dat %>% ggplot() +
  geom_bar(aes(x = date, group = in_out_patient, fill = in_out_patient))
```



Hospital names

```
cleaned_incidence_dat %>% tabyl(hospital)
```

```
                      hospital     n      percent
                       AN BINH    32 8.227723e-05
                 BENH VIEN 115     5 1.285582e-05
             BV BENH NHIET DOI 63000 1.619833e-01
                 BV BINH CHANH   167 4.293843e-04
                   BV BINH TAN   822 2.113496e-03
                 BV BINH THANH   259 6.659313e-04
                       BV DHYD     8 2.056931e-05
                    BV HOC MON   116 2.982550e-04
                     BV NHA BE   102 2.622587e-04
                  BV PHU NHUAN   159 4.088150e-04
                     BV QUAN 1   292 7.507797e-04
                    BV QUAN 11   333 8.561974e-04
                    BV QUAN 12   337 8.664821e-04
                     BV QUAN 3     4 1.028465e-05
                     BV QUAN 4   115 2.956838e-04
                     BV QUAN 5    13 3.342512e-05
                     BV QUAN 6   454 1.167308e-03
                     BV QUAN 7   174 4.473824e-04
                     BV QUAN 8    18 4.628094e-05
                     BV QUAN 9    21 5.399443e-05
               BV QUAN THU DUC   557 1.432138e-03
                   BV TAN BINH   801 2.059502e-03
                    BV TAN PHU  1157 2.974836e-03
                   BVDK CU CHI   596 1.532413e-03
                  BVDK THU DUC  2061 5.299168e-03
Bệnh viện Bệnh nhiệt đới TPHCM 72136 1.854734e-01
           Bệnh viện Pháp Việt    10 2.571163e-05
   Bệnh Viện Columbia Gia Định    10 2.571163e-05
            Bệnh Viện Hoàn Hảo     1 2.571163e-06
           Bệnh Viện Đức Khang    50 1.285582e-04
                 Bệnh viện 175    19 4.885210e-05
             Bệnh viện An Bình   281 7.224969e-04
             Bệnh viện An Sinh   352 9.050495e-04
             Bệnh viện Chợ Rẫy   501 1.288153e-03
       Bệnh viện Gaya Việt Hàn    76 1.954084e-04
          Bệnh viện Gia An 115   231 5.939387e-04
```

```
                                       Bệnh viện Hoàn Mỹ  8035 2.065930e-02
                              Bệnh viện Huyện Bình Chánh  1698 4.365835e-03
                                 Bệnh viện Huyện Cần Giờ   832 2.139208e-03
                                  Bệnh viện Huyện Củ Chi  1135 2.918270e-03
                                  Bệnh viện Huyện Nhà Bè  1727 4.440399e-03
                                  Bệnh viện Hồng Đức III  1387 3.566204e-03
                                      Bệnh viện Minh Anh    33 8.484839e-05
                                        Bệnh viện Mỹ Đức   545 1.401284e-03
                              Bệnh viện Mỹ Đức Phú Nhuận     3 7.713490e-06
                             Bệnh viện Nguyễn Tri Phương   576 1.480990e-03
                                   Bệnh viện Nguyễn Trãi   691 1.776674e-03
                                    Bệnh viện Nhi Đồng 1    20 5.142327e-05
                                    Bệnh viện Nhi đồng 1 21077 5.419241e-02
                                    Bệnh viện Nhi đồng 2 21521 5.533401e-02
                            Bệnh viện Nhi đồng thành phố  5416 1.392542e-02
                                  Bệnh viện Nhân Dân 115  1121 2.882274e-03
                             Bệnh viện Nhân Dân Gia Định   471 1.211018e-03
                             Bệnh viện Nhân dân Gia Định     4 1.028465e-05
                                     Bệnh viện Pháp Việt  1855 4.769508e-03
                                Bệnh viện Phụ sản MêKông    26 6.685025e-05
Bệnh viện Phục hồi chức năng - Điều trị Bệnh nghề nghiệp    18 4.628094e-05
                          Bệnh viện Quân dân Y Miền Đông  1440 3.702475e-03
                                        Bệnh viện Quận 1  3547 9.119916e-03
                                       Bệnh viện Quận 10   419 1.077317e-03
                                       Bệnh viện Quận 11  3623 9.315325e-03
                                       Bệnh viện Quận 12 10259 2.637757e-02
                                        Bệnh viện Quận 2  1582 4.067580e-03
                                        Bệnh viện Quận 3   606 1.558125e-03
                                        Bệnh viện Quận 4  1495 3.843889e-03
                                        Bệnh viện Quận 5   474 1.218731e-03
                                        Bệnh viện Quận 6  1202 3.090538e-03
                                        Bệnh viện Quận 7  1402 3.604771e-03
                                        Bệnh viện Quận 8  1089 2.799997e-03
                                        Bệnh viện Quận 9   904 2.324332e-03
                               Bệnh viện Quận Bình Thạnh 10473 2.692779e-02
                                 Bệnh viện Quận Bình Tân  8313 2.137408e-02
                                   Bệnh viện Quận Gò Vấp  1582 4.067580e-03
                                Bệnh viện Quận Phú Nhuận  1036 2.663725e-03
                                  Bệnh viện Quận Thủ Đức  3276 8.423131e-03
                                 Bệnh viện Quận Tân Bình  5607 1.441651e-02
                                  Bệnh viện Quận Tân Phú 26162 6.726678e-02
                                    Bệnh viện Quốc Tế Mỹ   257 6.607890e-04
                                  Bệnh viện Quốc tế City   488 1.254728e-03
```

```
                        Bệnh viện Quốc Ánh   808 2.077500e-03
                      Bệnh viện Thống Nhất  1530 3.933880e-03
                        Bệnh viện Triều An   513 1.319007e-03
                     Bệnh viện Trưng Vương  4381 1.126427e-02
                 Bệnh viện Tâm Trí Sài Gòn   665 1.709824e-03
                        Bệnh viện Tân Hưng   472 1.213589e-03
                           Bệnh viện Từ Dũ    31 7.970606e-05
                          Bệnh viện Vinmec   190 4.885210e-04
                        Bệnh viện Vạn Hạnh    38 9.770421e-05
                         Bệnh viện Xuyên Á  3796 9.760136e-03
                Bệnh viện huyện Bình Chánh    11 2.828280e-05
                    Bệnh viện huyện Củ Chi     5 1.285582e-05
                   Bệnh viện quận Bình Tân    37 9.513304e-05
                   Bệnh viện quận Tân Bình    14 3.599629e-05
                     Bệnh viện ĐKKV Củ Chi  7483 1.924002e-02
                    Bệnh viện ĐKKV Hóc Môn  6633 1.705453e-02
                    Bệnh viện ĐKKV Thủ Đức  4869 1.251899e-02
                Bệnh viện ĐKQT Nam Sài Gòn    15 3.856745e-05
            Bệnh viện Đa khoa Bưu Điện-CS1   540 1.388428e-03
            Bệnh viện Đa khoa Bưu Điện-CS3     1 2.571163e-06
          Bệnh viện Đa khoa Hoàn Hảo (Cs2)     2 5.142327e-06
     Bệnh viện Đa khoa Quốc tế Nam Sài Gòn     1 2.571163e-06
                 Bệnh viện Đa khoa Sài Gòn     6 1.542698e-05
                 Bệnh viện Đa khoa Tâm Anh  1294 3.327085e-03
       Bệnh viện Đa khoa khu vực Hậu Nghĩa     1 2.571163e-06
            Bệnh viện Đại học Y Dược TPHCM   699 1.797243e-03
             Bệnh viện đa khoa 30/4 Tp.HCM   713 1.833239e-03
Bệnh viện đa khoa Quốc Tế Hoàn Mỹ Thủ Đức    93 2.391182e-04
                 Bệnh viện đa khoa Sài Gòn   478 1.229016e-03
          Bệnh viện đa khoa quốc tế Vũ Anh   437 1.123598e-03
                                   CHO RAY    11 2.828280e-05
                                   DK 30/4    53 1.362717e-04
                                DK SAI GON    28 7.199257e-05
                                      HCDC     1 2.571163e-06
                               NGUYEN TRAI    94 2.416894e-04
                         NGUYEN TRI PHUONG   110 2.828280e-04
                         NHAN DAN GIA DINH  2329 5.988239e-03
                                NHI DONG 1 31033 7.979091e-02
                                NHI DONG 2 19117 4.915293e-02
                                 PHAP VIET    20 5.142327e-05
                             PK THANH CONG    21 5.399443e-05
        Phòng khám đa khoa Trần Diệp Khanh    87 2.236912e-04
                        QUAN DAN MIEN DONG    24 6.170792e-05
```

```
                                               THONG NHAT   555 1.426996e-03
                                              TRUNG VUONG   819 2.105783e-03
              Trung tâm Kiểm soát bệnh tật Tp.Hồ Chí Minh     2 5.142327e-06
                                   Trung tâm Y tế  Quận 1     1 2.571163e-06
                                   Trung tâm Y tế  Quận 3     1 2.571163e-06
                                   Trung tâm Y tế  Quận 9   112 2.879703e-04
                         Trung tâm Y tế  Quận Bình Thạnh     5 1.285582e-05
                            Trung tâm Y tế  Quận Bình Tân     1 2.571163e-06
                           Trung tâm Y tế  Quận Phú Nhuận     2 5.142327e-06
               Trung tâm kiểm soát bệnh tật Thành phố HCM     1 2.571163e-06
                        Trung tâm y tế Dự phòng TP. H.C.M     1 2.571163e-06
                                Trạm Y tế  Phuoc Tan Hung     2 5.142327e-06
                                     Trạm Y tế  Phường 03     1 2.571163e-06
                            Trạm Y tế  Phường An Lợi Đông     2 5.142327e-06
                                 Trạm Y tế  Phường An Phú     5 1.285582e-05
                                Trạm Y tế  Phường Bình An     2 5.142327e-06
                             Trạm Y tế  Phường Bình Khánh     1 2.571163e-06
                        Trạm Y tế  Phường Bình Trưng Đông     3 7.713490e-06
                                Trạm Y tế  Phường Cát Lái     1 2.571163e-06
                                    Trạm Y tế xã Hiệp Hòa     1 2.571163e-06
                                 Trạm y tế Bình Trưng Tây     3 7.713490e-06
                                           Viện Tim TPHCM     3 7.713490e-06
                                    bv.nd2.khth@gmail.com    24 6.170792e-05
```

Normalise hospital names

```
s1_cleaned_incidence_dat <- cleaned_incidence_dat %>%
  mutate(
    hospital = stri_trans_general(hospital, id = "Latin-ASCII") %>% tolower(),
    hospital = gsub("\\s+", " ", hospital) %>% str_replace("bv", "benh vien")
  )

s1_cleaned_incidence_dat %>%
  tabyl(hospital) %>%
  arrange(desc(n))
```

```
                                                 hospital     n      percent
                           benh vien benh nhiet doi tphcm 72136 1.854734e-01
                                 benh vien benh nhiet doi 63000 1.619833e-01
                                               nhi dong 1 31033 7.979091e-02
                                   benh vien quan tan phu 26162 6.726678e-02
                                     benh vien nhi dong 2 21521 5.533401e-02
```

```
          benh vien nhi dong 1 21097 5.424383e-02
                    nhi dong 2 19117 4.915293e-02
             benh vien quan 12 10596 2.724405e-02
     benh vien quan binh thanh 10473 2.692779e-02
       benh vien quan binh tan  8350 2.146921e-02
             benh vien hoan my  8035 2.065930e-02
         benh vien dkkv cu chi  7483 1.924002e-02
        benh vien dkkv hoc mon  6633 1.705453e-02
       benh vien quan tan binh  5621 1.445251e-02
  benh vien nhi dong thanh pho  5416 1.392542e-02
        benh vien dkkv thu duc  4869 1.251899e-02
         benh vien trung vuong  4381 1.126427e-02
             benh vien quan 11  3956 1.017152e-02
              benh vien quan 1  3839 9.870696e-03
        benh vien quan thu duc  3833 9.855269e-03
            benh vien xuyen a  3796 9.760136e-03
             nhan dan gia dinh  2329 5.988239e-03
           benh viendk thu duc  2061 5.299168e-03
           benh vien phap viet  1865 4.795220e-03
        benh vien huyen nha be  1727 4.440399e-03
    benh vien huyen binh chanh  1709 4.394118e-03
              benh vien quan 6  1656 4.257847e-03
              benh vien quan 4  1610 4.139573e-03
              benh vien quan 2  1582 4.067580e-03
         benh vien quan go vap  1582 4.067580e-03
              benh vien quan 7  1576 4.052153e-03
          benh vien thong nhat  1530 3.933880e-03
benh vien quan dan y mien dong  1440 3.702475e-03
        benh vien hong duc iii  1387 3.566204e-03
     benh vien da khoa tam anh  1294 3.327085e-03
             benh vien tan phu  1157 2.974836e-03
        benh vien huyen cu chi  1140 2.931126e-03
        benh vien nhan dan 115  1121 2.882274e-03
              benh vien quan 8  1107 2.846278e-03
      benh vien quan phu nhuan  1036 2.663725e-03
              benh vien quan 9   925 2.378326e-03
       benh vien huyen can gio   832 2.139208e-03
            benh vien binh tan   822 2.113496e-03
                   trung vuong   819 2.105783e-03
            benh vien quoc anh   808 2.077500e-03
            benh vien tan binh   801 2.059502e-03
 benh vien da khoa 30/4 tp.hcm   713 1.833239e-03
benh vien dai hoc y duoc tphcm   699 1.797243e-03
```

```
                    benh vien nguyen trai   691 1.776674e-03
                benh vien tam tri sai gon   665 1.709824e-03
                         benh vien quan 3   610 1.568410e-03
                       benh viendk cu chi   596 1.532413e-03
              benh vien nguyen tri phuong   576 1.480990e-03
                               thong nhat   555 1.426996e-03
                         benh vien my duc   545 1.401284e-03
           benh vien da khoa buu dien-cs1   540 1.388428e-03
                       benh vien trieu an   513 1.319007e-03
                        benh vien cho ray   501 1.288153e-03
                   benh vien quoc te city   488 1.254728e-03
                         benh vien quan 5   487 1.252157e-03
                benh vien da khoa sai gon   484 1.244443e-03
              benh vien nhan dan gia dinh   475 1.221303e-03
                       benh vien tan hung   472 1.213589e-03
         benh vien da khoa quoc te vu anh   437 1.123598e-03
                        benh vien quan 10   419 1.077317e-03
                        benh vien an sinh   352 9.050495e-04
                        benh vien an binh   281 7.224969e-04
                     benh vien binh thanh   259 6.659313e-04
                     benh vien quoc te my   257 6.607890e-04
                     benh vien gia an 115   231 5.939387e-04
                         benh vien vinmec   190 4.885210e-04
                     benh vien binh chanh   167 4.293843e-04
                      benh vien phu nhuan   159 4.088150e-04
                        benh vien hoc mon   116 2.982550e-04
                    trung tam y te quan 9   112 2.879703e-04
                        nguyen tri phuong   110 2.828280e-04
                         benh vien nha be   102 2.622587e-04
                              nguyen trai    94 2.416894e-04
benh vien da khoa quoc te hoan my thu duc    93 2.391182e-04
       phong kham da khoa tran diep khanh    87 2.236912e-04
                  benh vien gaya viet han    76 1.954084e-04
                                  dk 30/4    53 1.362717e-04
                      benh vien duc khang    50 1.285582e-04
                       benh vien van hanh    38 9.770421e-05
                       benh vien minh anh    33 8.484839e-05
                                  an binh    32 8.227723e-05
                          benh vien tu du    31 7.970606e-05
                               dk sai gon    28 7.199257e-05
                 benh vien phu san mekong    26 6.685025e-05
             benh vien.nd2.khth@gmail.com    24 6.170792e-05
                       quan dan mien dong    24 6.170792e-05
```

```
                                            pk thanh cong    21 5.399443e-05
                                                phap viet    20 5.142327e-05
                                            benh vien 175    19 4.885210e-05
 benh vien phuc hoi chuc nang - dieu tri benh nghe nghiep    18 4.628094e-05
                               benh vien dkqt nam sai gon    15 3.856745e-05
                                                  cho ray    11 2.828280e-05
                              benh vien columbia gia dinh    10 2.571163e-05
                                           benh vien dhyd     8 2.056931e-05
                                            benh vien 115     5 1.285582e-05
                                  tram y te phuong an phu     5 1.285582e-05
                           trung tam y te quan binh thanh     5 1.285582e-05
                               benh vien my duc phu nhuan     3 7.713490e-06
                                 tram y te binh trung tay     3 7.713490e-06
                         tram y te phuong binh trung dong     3 7.713490e-06
                                           vien tim tphcm     3 7.713490e-06
                        benh vien da khoa hoan hao (cs2)      2 5.142327e-06
                                 tram y te phuoc tan hung     2 5.142327e-06
                             tram y te phuong an loi dong     2 5.142327e-06
                                 tram y te phuong binh an     2 5.142327e-06
              trung tam kiem soat benh tat tp.ho chi minh     2 5.142327e-06
                            trung tam y te quan phu nhuan     2 5.142327e-06
                           benh vien da khoa buu dien-cs3     1 2.571163e-06
                      benh vien da khoa khu vuc hau nghia     1 2.571163e-06
                    benh vien da khoa quoc te nam sai gon     1 2.571163e-06
                                       benh vien hoan hao     1 2.571163e-06
                                                     hcdc     1 2.571163e-06
                                      tram y te phuong 03     1 2.571163e-06
                              tram y te phuong binh khanh     1 2.571163e-06
                                 tram y te phuong cat lai     1 2.571163e-06
                                    tram y te xa hiep hoa     1 2.571163e-06
               trung tam kiem soat benh tat thanh pho hcm     1 2.571163e-06
                        trung tam y te du phong tp. h.c.m     1 2.571163e-06
                                    trung tam y te quan 1     1 2.571163e-06
                                    trung tam y te quan 3     1 2.571163e-06
                             trung tam y te quan binh tan     1 2.571163e-06
```

Coding the names of the most busy hospitals

```
s2_cleaned_incidence_dat <- s1_cleaned_incidence_dat %>% mutate(
  hospital = case_when(
    str_detect(hospital, "benh vien benh nhiet doi") ~ "HTD",
    str_detect(hospital, "nhi dong 1") ~ "CH1",
```

```r
    str_detect(hospital, "(nhi dong 2)|nd2") ~ "CH2",
    str_detect(hospital, "nhi dong thanh pho") ~ "CHC",
    str_detect(hospital, "tan phu") ~ "TPH",
    .default = hospital
  )
)

s2_cleaned_incidence_dat %>%
  tabyl(hospital) %>%
  arrange(desc(n))
```

```
                      hospital      n      percent
                           HTD 135136 3.474567e-01
                           CH1  52130 1.340347e-01
                           CH2  40662 1.045486e-01
                           TPH  27319 7.024161e-02
             benh vien quan 12  10596 2.724405e-02
     benh vien quan binh thanh  10473 2.692779e-02
       benh vien quan binh tan   8350 2.146921e-02
             benh vien hoan my   8035 2.065930e-02
         benh vien dkkv cu chi   7483 1.924002e-02
        benh vien dkkv hoc mon   6633 1.705453e-02
       benh vien quan tan binh   5621 1.445251e-02
                           CHC   5416 1.392542e-02
        benh vien dkkv thu duc   4869 1.251899e-02
         benh vien trung vuong   4381 1.126427e-02
             benh vien quan 11   3956 1.017152e-02
              benh vien quan 1   3839 9.870696e-03
        benh vien quan thu duc   3833 9.855269e-03
             benh vien xuyen a   3796 9.760136e-03
             nhan dan gia dinh   2329 5.988239e-03
           benh viendk thu duc   2061 5.299168e-03
           benh vien phap viet   1865 4.795220e-03
        benh vien huyen nha be   1727 4.440399e-03
    benh vien huyen binh chanh   1709 4.394118e-03
              benh vien quan 6   1656 4.257847e-03
              benh vien quan 4   1610 4.139573e-03
              benh vien quan 2   1582 4.067580e-03
         benh vien quan go vap   1582 4.067580e-03
              benh vien quan 7   1576 4.052153e-03
          benh vien thong nhat   1530 3.933880e-03
benh vien quan dan y mien dong   1440 3.702475e-03
```

```
          benh vien hong duc iii   1387 3.566204e-03
       benh vien da khoa tam anh   1294 3.327085e-03
          benh vien huyen cu chi   1140 2.931126e-03
          benh vien nhan dan 115   1121 2.882274e-03
                benh vien quan 8   1107 2.846278e-03
        benh vien quan phu nhuan   1036 2.663725e-03
                benh vien quan 9    925 2.378326e-03
         benh vien huyen can gio    832 2.139208e-03
              benh vien binh tan    822 2.113496e-03
                     trung vuong    819 2.105783e-03
              benh vien quoc anh    808 2.077500e-03
              benh vien tan binh    801 2.059502e-03
   benh vien da khoa 30/4 tp.hcm    713 1.833239e-03
  benh vien dai hoc y duoc tphcm    699 1.797243e-03
           benh vien nguyen trai    691 1.776674e-03
       benh vien tam tri sai gon    665 1.709824e-03
                benh vien quan 3    610 1.568410e-03
              benh viendk cu chi    596 1.532413e-03
     benh vien nguyen tri phuong    576 1.480990e-03
                      thong nhat    555 1.426996e-03
                benh vien my duc    545 1.401284e-03
  benh vien da khoa buu dien-cs1    540 1.388428e-03
              benh vien trieu an    513 1.319007e-03
               benh vien cho ray    501 1.288153e-03
          benh vien quoc te city    488 1.254728e-03
                benh vien quan 5    487 1.252157e-03
       benh vien da khoa sai gon    484 1.244443e-03
     benh vien nhan dan gia dinh    475 1.221303e-03
              benh vien tan hung    472 1.213589e-03
benh vien da khoa quoc te vu anh    437 1.123598e-03
               benh vien quan 10    419 1.077317e-03
               benh vien an sinh    352 9.050495e-04
               benh vien an binh    281 7.224969e-04
            benh vien binh thanh    259 6.659313e-04
            benh vien quoc te my    257 6.607890e-04
            benh vien gia an 115    231 5.939387e-04
                benh vien vinmec    190 4.885210e-04
            benh vien binh chanh    167 4.293843e-04
             benh vien phu nhuan    159 4.088150e-04
               benh vien hoc mon    116 2.982550e-04
           trung tam y te quan 9    112 2.879703e-04
               nguyen tri phuong    110 2.828280e-04
                benh vien nha be    102 2.622587e-04
```

```
                                             nguyen trai    94 2.416894e-04
               benh vien da khoa quoc te hoan my thu duc    93 2.391182e-04
                      phong kham da khoa tran diep khanh    87 2.236912e-04
                                 benh vien gaya viet han    76 1.954084e-04
                                                 dk 30/4    53 1.362717e-04
                                     benh vien duc khang    50 1.285582e-04
                                      benh vien van hanh    38 9.770421e-05
                                      benh vien minh anh    33 8.484839e-05
                                                 an binh    32 8.227723e-05
                                         benh vien tu du    31 7.970606e-05
                                              dk sai gon    28 7.199257e-05
                                benh vien phu san mekong    26 6.685025e-05
                                      quan dan mien dong    24 6.170792e-05
                                           pk thanh cong    21 5.399443e-05
                                               phap viet    20 5.142327e-05
                                           benh vien 175    19 4.885210e-05
benh vien phuc hoi chuc nang - dieu tri benh nghe nghiep    18 4.628094e-05
                              benh vien dkqt nam sai gon    15 3.856745e-05
                                                 cho ray    11 2.828280e-05
                             benh vien columbia gia dinh    10 2.571163e-05
                                          benh vien dhyd     8 2.056931e-05
                                           benh vien 115     5 1.285582e-05
                                 tram y te phuong an phu     5 1.285582e-05
                          trung tam y te quan binh thanh     5 1.285582e-05
                             benh vien my duc phu nhuan     3 7.713490e-06
                                tram y te binh trung tay     3 7.713490e-06
                        tram y te phuong binh trung dong     3 7.713490e-06
                                          vien tim tphcm     3 7.713490e-06
                        benh vien da khoa hoan hao (cs2)     2 5.142327e-06
                                tram y te phuoc tan hung     2 5.142327e-06
                            tram y te phuong an loi dong     2 5.142327e-06
                                tram y te phuong binh an     2 5.142327e-06
             trung tam kiem soat benh tat tp.ho chi minh     2 5.142327e-06
                          trung tam y te quan phu nhuan     2 5.142327e-06
                          benh vien da khoa buu dien-cs3     1 2.571163e-06
                     benh vien da khoa khu vuc hau nghia     1 2.571163e-06
                   benh vien da khoa quoc te nam sai gon     1 2.571163e-06
                                      benh vien hoan hao     1 2.571163e-06
                                                    hcdc     1 2.571163e-06
                                     tram y te phuong 03     1 2.571163e-06
                             tram y te phuong binh khanh     1 2.571163e-06
                                tram y te phuong cat lai     1 2.571163e-06
                                   tram y te xa hiep hoa     1 2.571163e-06
              trung tam kiem soat benh tat thanh pho hcm      1 2.571163e-06
                       trung tam y te du phong tp. h.c.m      1 2.571163e-06
                                   trung tam y te quan 1      1 2.571163e-06
                                   trung tam y te quan 3      1 2.571163e-06
                            trung tam y te quan binh tan      1 2.571163e-06
```

Normalise district and commune

Let’s normalise district names from the 2 different reporting systems

```r
s2_cleaned_incidence_dat %>%
  tabyl(district)
```

```
         district     n     percent
               01  4479 0.011516241
               02  2201 0.005659131
               03  3905 0.010040393
               04  3333 0.008569688
               05  4435 0.011403110
               06  7584 0.019499703
               07  6352 0.016332030
               08 12223 0.031427330
               09  3205 0.008240579
               10  5344 0.013740297
               11  5848 0.015036163
               12  5191 0.013346909
      BINH CHANH  7801 0.020057645
        BINH TAN  8820 0.022677661
      BINH THANH  6418 0.016501727
         CAN GIO   994 0.002555736
          CU CHI  2030 0.005219462
          GO VAP  4916 0.012639839
         HOC MON  3994 0.010269227
          NHA BE  2608 0.006705594
       PHU NHUAN  2182 0.005610278
        TAN BINH  9393 0.024150938
         TAN PHU  6949 0.017867014
         THU DUC  5591 0.014375374
 huyện bình chánh 22955 0.059021055
    huyện cần giờ  1754 0.004509821
     huyện củ chi 12295 0.031612454
    huyện hóc môn 15597 0.040102435
     huyện nhà bè  5739 0.014755907
          quận 1  6923 0.017800164
         quận 10  5559 0.014293097
         quận 11  6063 0.015588964
         quận 12 19205 0.049379193
          quận 2  4867 0.012513852
          quận 3  5392 0.013863713
          quận 4  4625 0.011891631
          quận 5  4543 0.011680795
          quận 6  6563 0.016874545
          quận 7  9305 0.023924675
          quận 8 12411 0.031910709
          quận 9  9321 0.023965814
 quận bình thạnh 14128 0.036325396
    quận bình tân 31456 0.080878515
      quận gò vấp  9906 0.025469944
   quận phú nhuận  4428 0.011385111
     quận thủ đức 12428 0.031954418
    quận tân bình 15722 0.040423831
     quận tân phú 21948 0.056431894
```

```
s3_cleaned_incidence_dat <- s2_cleaned_incidence_dat %>%
  mutate(district = stri_trans_general(district, id = "Latin-ASCII") %>% tolower()) %>%
  mutate(district = str_remove(district, "huyen|quan") %>% trimws()) %>%
  mutate(district = trimws(district, which = "left", whitespace = "0"))

s3_cleaned_incidence_dat %>%
  tabyl(district)
```

```
   district     n     percent
          1 11402 0.029316405
         10 10903 0.028033394
         11 11911 0.030625127
         12 24396 0.062726102
          2  7068 0.018172983
          3  9297 0.023904106
          4  7958 0.020461318
          5  8978 0.023083905
          6 14147 0.036374248
          7 15657 0.040256705
          8 24634 0.063338039
```

```
           9 12526 0.032206392
 binh chanh 30756 0.079078701
   binh tan 40276 0.103556176
 binh thanh 20546 0.052827123
    can gio  2748 0.007065557
     cu chi 14325 0.036831915
     go vap 14822 0.038109784
    hoc mon 19591 0.050371662
     nha be  8347 0.021461501
  phu nhuan  6610 0.016995390
   tan binh 25115 0.064574768
    tan phu 28897 0.074298908
    thu duc 18019 0.046329793
```

Now normalise commune names

```r
s3_cleaned_incidence_dat %>%
  tabyl(district, commune) %>%
  View()
```

Export to CSV

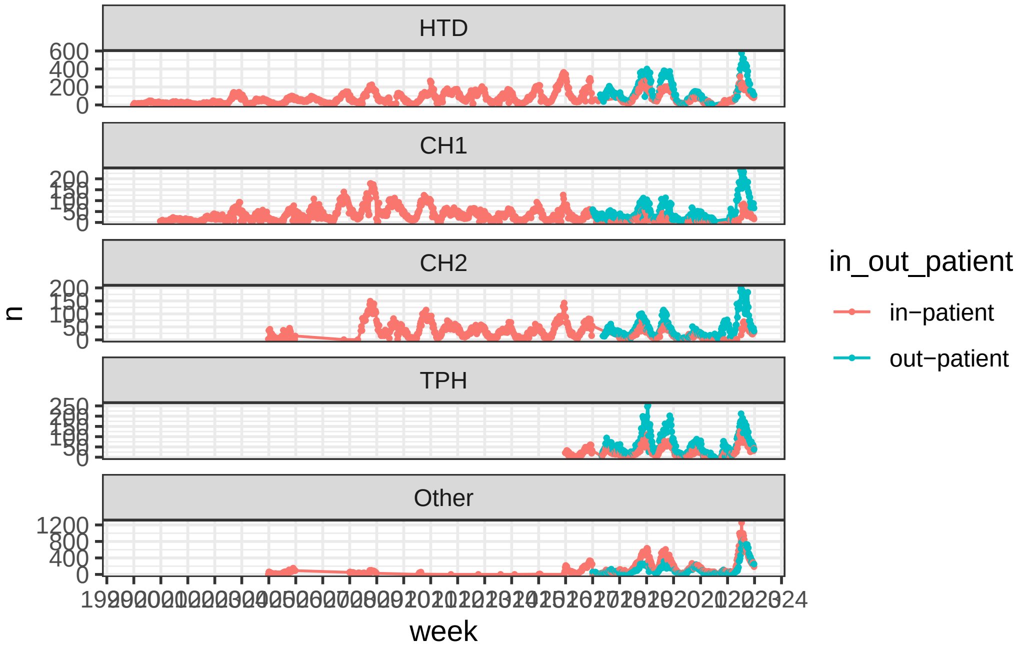
```r
s3_cleaned_incidence_dat %>% write_csv("incidence_full.csv")
```

Data viz

Total number of cases per hospital

```r
hospital_order <- s3_cleaned_incidence_dat %>%
  mutate(week = lubridate::floor_date(date, "week")) %>%
  group_by(hospital) %>%
  tally(name = "total_n") %>%
  arrange(desc(total_n)) %>%
  pull(hospital)


s3_cleaned_incidence_dat %>%
  filter(in_out_patient %in% c("in-patient", "out-patient")) %>%
  mutate(
    week = lubridate::floor_date(date, "week"),
    # hospitals take make up less the 5% of total cases will be put in "Other"
    hospital = factor(hospital, levels = hospital_order) %>% fct_lump_prop(0.05)
  ) %>%
  group_by(week, in_out_patient, hospital) %>%
  tally() %>%
  ggplot(aes(x = week, y = n, color = in_out_patient)) +
  geom_line() +
  geom_point(size = 0.5) +
  scale_x_date(date_breaks = "1 year", date_labels = "%Y", minor_breaks = NULL) +
  #   facet_wrap(~hospital, ncol = 1)
  facet_wrap(~hospital, ncol = 1, scales = "free_y")
```



```
#   theme(legend.position = "none")
```

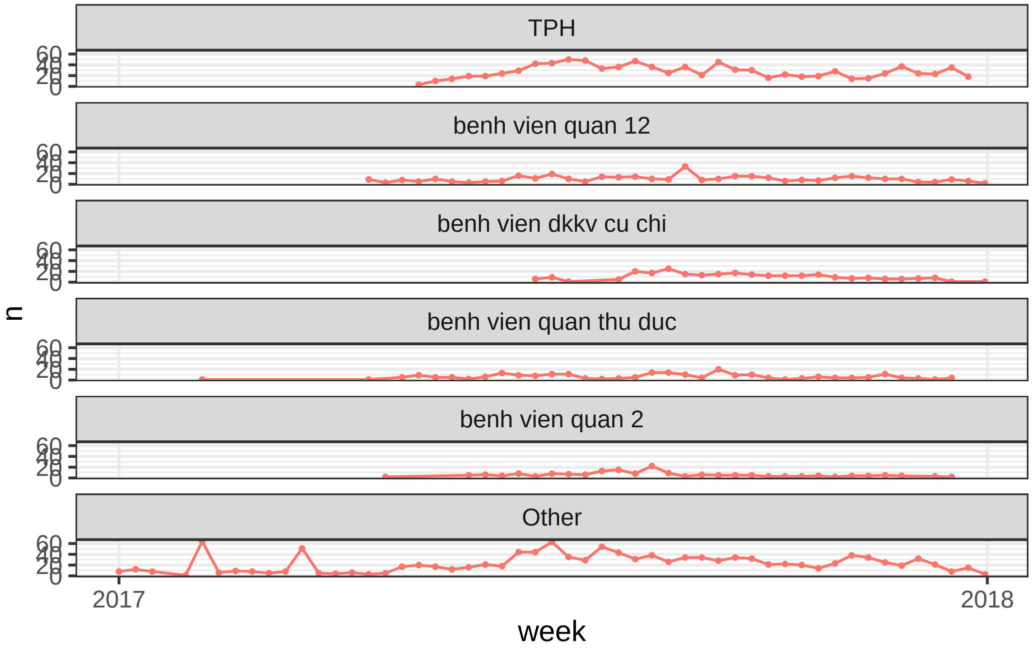
We can see some weird period where there are so little in-patient data from big hospitals like in 2017.

Let's zoom into that

```r
s3_cleaned_incidence_dat %>%
  filter(year(date) == 2017, in_out_patient == "in-patient") %>%
  tabyl(hospital) %>%
  arrange(desc(n))
```

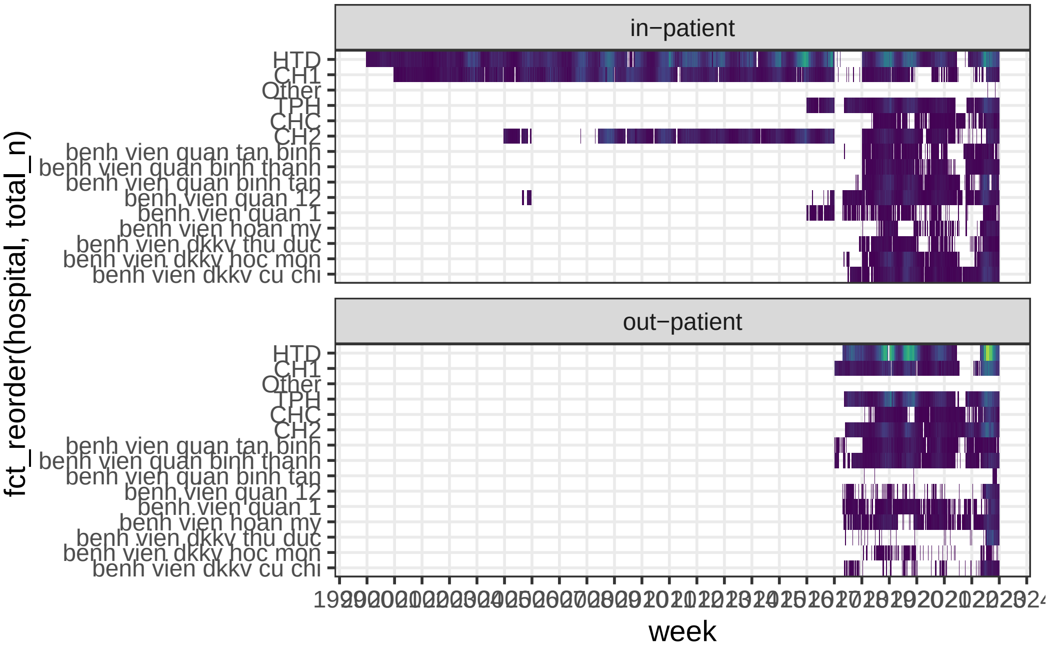
```
                        hospital   n      percent
                             TPH 934 0.2953826692
               benh vien quan 12 373 0.1179633144
           benh vien dkkv cu chi 260 0.0822264390
          benh vien quan thu duc 230 0.0727387729
                benh vien quan 2 177 0.0559772296
  benh vien quan dan y mien dong 139 0.0439595193
                             HTD 102 0.0322580645
              benh vien quoc anh  81 0.0256166983
       benh vien tam tri sai gon  70 0.0221378874
                benh vien quan 9  69 0.0218216319
                benh vien quan 5  67 0.0211891208
                benh vien quan 1  65 0.0205566097
                benh vien quan 6  63 0.0199240987
           trung tam y te quan 9  52 0.0164452878
              benh vien trieu an  47 0.0148640101
               benh vien an binh  46 0.0145477546
   benh vien da khoa 30/4 tp.hcm  41 0.0129664769
          benh vien dkkv hoc mon  37 0.0117014548
      benh vien huyen binh chanh  27 0.0085388994
                benh vien quan 4  24 0.0075901328
                benh vien quan 8  23 0.0072738773
               benh vien xuyen a  22 0.0069576218
benh vien da khoa quoc te vu anh  20 0.0063251107
               benh vien quan 11  19 0.0060088552
  benh vien da khoa buu dien-cs1  16 0.0050600886
          benh vien nhan dan 115  16 0.0050600886
        benh vien quan phu nhuan  15 0.0047438330
                benh vien vinmec  14 0.0044275775
                   benh vien 175  13 0.0041113219
         benh vien huyen can gio  11 0.0034788109
           benh vien nguyen trai  11 0.0034788109
          benh vien dkkv thu duc  10 0.0031625553
                             CH1   9 0.0028462998
       benh vien da khoa sai gon   9 0.0028462998
          benh vien huyen nha be   9 0.0028462998
                benh vien quan 3   8 0.0025300443
           benh vien quan go vap   7 0.0022137887
             benh vien phap viet   4 0.0012650221
                benh vien quan 7   4 0.0012650221
         benh vien quan binh tan   4 0.0012650221
              benh vien tan hung   4 0.0012650221
           benh vien trung vuong   4 0.0012650221
         benh vien quan tan binh   2 0.0006325111
            benh vien thong nhat   2 0.0006325111
               benh vien cho ray   1 0.0003162555
           trung tam y te quan 1   1 0.0003162555
```

```
s3_cleaned_incidence_dat %>%
  filter(year(date) == 2017, in_out_patient == "in-patient") %>%
  mutate(
    week = lubridate::floor_date(date, "week"),
    hospital = factor(hospital, levels = hospital_order) %>% fct_lump_prop(0.05)
  ) %>%
  group_by(week, in_out_patient, hospital) %>%
  tally() %>%
  ggplot(aes(x = week, y = n, color = in_out_patient)) +
  geom_line() +
  geom_point(size = 0.5) +
  scale_x_date(date_breaks = "1 year", date_labels = "%Y", minor_breaks = NULL) +
  facet_wrap(~hospital, ncol = 1) +
  #   facet_wrap(~hospital, ncol = 1, scales = "free_y")
  theme(legend.position = "none")
```



Data availability map

```
s3_cleaned_incidence_dat %>%
  mutate(week = floor_date(date, "week")) %>%
  group_by(week, in_out_patient, hospital) %>%
  tally() %>%
  ungroup() %>%
  complete(week, in_out_patient, hospital) %>%
  filter(in_out_patient %in% c("in-patient", "out-patient")) %>%
  group_by(week, in_out_patient, hospital) %>%
  mutate(total_n = sum(n, na.rm = TRUE)) %>%
  ungroup() %>%
  mutate(hospital = fct_lump_prop(hospital, prop = 0.01, w = total_n)) %>%
  ggplot(aes(x = week, y = fct_reorder(hospital, total_n), fill = n)) +
  geom_raster() +
  facet_wrap(~in_out_patient, ncol = 1) +
  theme(legend.position = "none") +
  scale_x_date(date_breaks = "1 year", date_labels = "%Y", minor_breaks = NULL) +
  scale_fill_viridis_c(na.value = "transparent")
```


in−patient
out−patient
fct_reorder(hospital, total_n)
HTD
CH1
Other
TPH
CHC
CH2
benh vien quan tan binh
benh vien quan binh thanh
benh vien quan binh tan
benh vien quan 12
benh vien quan 1
benh vien hoan my
benh vien dkkv thu duc
benh vien dkkv hoc mon
benh vien dkkv cu chi
19992000200120022003200420052006200720082009201020112012201320142015201620172018201920202021202220232024
week