TABLE ONE AND PLOTS

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```r
 library(MASS)
library(tidyverse)
library(finalfit)
library(gtsummary)
library(patchwork)
library(broom)
#library(conflicted)
library(gt)
#conflict_prefer("select", "dplyr")
```

```r
rakai = read_csv("rakai_updated.csv")
dim(rakai)
```

```
[1] 2839    79
```

```r
#glimpse(rakai)
#missing_glimpse(rakai)
```

```r
df1 <- rakai %>%
  select(ageyrs,sex,locate,occup1,currmarr,evermarr,mobility,
         artdays,artwks,artmos,artyrs,comm_num,educyrs,religion)
```

```r
df2 <- rakai %>%
  select(ageyrs,sex,locate,occup1,currmarr,evermarr,mobility,
  artdays,artwks,artmos,artyrs,comm_num,artrunbc,artstrbc,hivac,copies,new_copies)
```

```r
df3 <- df1 %>%
  mutate(ageyrs = ageyrs %>%  ff_label("Age (years)"),
         sex = if_else(sex == "F","Female","Male") %>%
           as_factor() %>%
```

```r
    fct_relevel("Female") %>%
    ff_label("Sex"),
  mobility = case_when(
    mobility %in% c(3,8,10) ~ "In-migrant",
    .default = "Long-term resident") %>%
    fct_relevel("In-migrant") %>%
    ff_label("Migration"),
  community_type = case_when(
    comm_num %in% c(38,770,771,774) ~ "Fishing community",
                              .default = "Inland Community") %>%
    fct_relevel("Inland Community") %>%
    ff_label("Community type"),
  fishing_comm = if_else(community_type == "Fishing Community",1,0) %>%
    ff_label("Lake Victoria Fishing Community"),

  primary_occupation = case_when(
    occup1 %in% c(1,2,5) ~ "Agriculture/Homebrewing",
    occup1 %in% c(10,11) ~ "Trading or shopkeeping",
    occup1 %in% c(12,18) ~ "Bar work or waitressing",
    occup1 %in% c(2,3,4) ~ "House work",
    occup1  == 7 ~ "Fishing-related occupation",
    .default = "Other") %>%
    fct_relevel("Agriculture/Homebrewing","Trading or shopkeeping") %>%
    ff_label("Primary Occupation"),

  age_cat = case_when(
                      ageyrs < 30 ~ "<30",
                      ageyrs >= 30 & ageyrs <= 39 ~  "30-39",
                      ageyrs >=40 & ageyrs <= 49 ~ "40-49") %>%
    fct_relevel("<30") %>%
    ff_label("Age group"),

  current_marital_status = case_when(
    currmarr == 1 ~ "Currently married",
    currmarr == 2 ~ "Previously married",
    currmarr == 8 ~ "Never married"
    ) %>%
    fct_relevel("Never married","Currently married") %>%
    ff_label("Current marital status"),

  art_duration = case_when(
    artyrs >= 1 & artyrs < 2 ~ "1-2 years",
```

```
        artyrs > 2 &  artyrs <= 5 ~ "2-5 years",
        artyrs > 5 ~ ">5 years",
        .default =  "<1 year"
      ) %>%
        fct_relevel("<1 year","1-2 years","2-5 years") %>%
        ff_label("Time on ART"),

      education_level = case_when(
        educyrs == 8 ~ "No formal education",
        educyrs %in% c(1,2) ~ "Primary",
        educyrs %in% c(3,4) ~ "Secondary",
        educyrs %in% c(5,6,7,10,11) ~ "Technical/University"

       ) %>%
        fct_relevel("No formal education") %>%
        ff_label("Educational attainment"),

      religion = case_when(
        religion %in% c(1,6) ~ "Other or none",
        religion %in% c(2,3,4) ~ "Catholic/Christian",
        religion == 5 ~ "Muslim"
      ) %>%
        ff_label("Religion")


  )
```

```
df4 <- df3 %>%
  select(
    ageyrs,age_cat,sex,current_marital_status,education_level,primary_occupation,
    mobility,community_type,art_duration
  )
```

Table One

```
df4 %>%
  tbl_summary(
    by = sex,
    statistic = list(
      all_categorical() ~ "{n} ({p}%)",
```

```
      all_continuous()  ~ "{median} ({IQR})"
    ),
    digits = list(
      all_categorical() ~ 0,
      all_continuous()  ~ 0
    )
  ) %>%
  add_overall() %>%
   bold_labels() %>%
  italicize_levels() %>%
  modify_spanning_header(
    update = all_stat_cols() ~ "**Sex**"
  )
```

```
df5 <- rakai %>%
  select(sex,artrunbc,artrunac,
         hivac,hivbc,copies,new_copies,artstrac,artstrbc) %>%
  filter(hivac !=8, hivbc!=8,artrunbc!=8,artstrac!=8,artstrbc!=8,artrunac!=8)
```

```
df6 <- df5 %>%
  mutate(
    sex = if_else(sex == "F","Female","Male") %>%
      as_factor() %>%
      fct_relevel("Female") %>%
      as_factor() %>%
      ff_label("Sex"),

    hivac = if_else(hivac ==1, "Yes","No") %>%
    ff_label("Missed scheduled visit for HIV care") %>%
      as_factor(),

     hivbc = if_else(hivbc ==1,"Yes","No") %>%
    ff_label("Missed scheduled visit for HIV care") %>%
    as_factor(),

     artrunac = if_else(artrunac ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Run out of ART before next refill"),

   artrunbc = if_else(artrunbc ==1,"Yes","No") %>%
     as_factor() %>%
```

Characteristic	Sex		
	Overall N = 2,839[1]	**Female** N = 1,824[1]	**Male** N = 1,015[1]
Age (years)	38 (11)	37 (11)	39 (9)
Age group			
<30	437 (15%)	347 (19%)	90 (9%)
30-39	1,229 (43%)	809 (44%)	420 (41%)
40-49	1,173 (41%)	668 (37%)	505 (50%)
Current marital status			
Never married	142 (5%)	96 (5%)	46 (5%)
Currently married	1,720 (61%)	1,036 (57%)	684 (67%)
Previously married	977 (34%)	692 (38%)	285 (28%)
Educational attainment			
No formal education	266 (9%)	174 (10%)	92 (9%)
Primary	1,931 (68%)	1,193 (65%)	738 (73%)
Secondary	406 (14%)	287 (16%)	119 (12%)
Technical/University	236 (8%)	170 (9%)	66 (7%)
Primary Occupation			
Agriculture/Homebrewing	709 (25%)	529 (29%)	180 (18%)
Trading or shopkeeping	543 (19%)	430 (24%)	113 (11%)
Bar work or waitressing	282 (10%)	278 (15%)	4 (0%)
Fishing-related occupation	504 (18%)	3 (0%)	501 (49%)
House work	287 (10%)	283 (16%)	4 (0%)
Other	514 (18%)	301 (17%)	213 (21%)
Migration			
In-migrant	637 (22%)	464 (25%)	173 (17%)
Long-term resident	2,202 (78%)	1,360 (75%)	842 (83%)
Community type			
Inland Community	1,284 (45%)	943 (52%)	341 (34%)
Fishing community	1,555 (55%)	881 (48%)	674 (66%)
Time on ART			
<1 year	222 (8%)	152 (8%)	70 (7%)
1-2 years	79 (3%)	50 (3%)	29 (3%)
2-5 years	750 (26%)	446 (24%)	304 (30%)
>5 years	1,788 (63%)	1,176 (64%)	612 (60%)

[1]Median (IQR); n (%)

```
    ff_label("Run out of ART before next refill"),

  artstrac = if_else(artstrac ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply"),

  artstrbc = if_else(artstrbc ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply")
  )
```

Viral Load Suppression

```
df7 <- df6 %>% filter(copies != "INV.IC ",!is.na(copies),!is.na(new_copies)) %>%
  mutate(
    copies = str_remove_all(copies, "<\\s*"),
    copies = if_else(copies == "BD", "0", copies),
    copies = as.numeric(copies),

    new_copies = str_remove_all(new_copies, "<\\s*"),
    new_copies = if_else(new_copies == "BD", "0", new_copies),
    new_copies = as.numeric(new_copies)
  ) %>%
  mutate(viral_load_b4 = if_else(copies < 200, "Viral Load Sppression","Viraemia") %>%
         ff_label("HIV RNA viral load, in copies/ml"),
       viral_load_after = if_else(new_copies < 200,"Viral Load Sppression","Viraemia") %>%
         ff_label("HIV RNA viral load, in copies/ml"))
```

```
df_vl_supp  <- df7 %>%
  mutate(
    suppbc = if_else(viral_load_b4 == "Viral Load Suppression", 1, 0),
    suppac = if_else(viral_load_after == "Viral Load Suppression", 1, 0)
  ) %>%
  select(-c(copies,new_copies))%>%
  pivot_longer(
    cols = c(viral_load_b4,viral_load_after),
    names_to = "variable",
    values_to = "viral_load"
```

```
  ) %>%
  mutate(
    time = if_else(grepl("b4$", variable), "Before Covid-19", "After Covid-19"),
  )


df_vl_summary <- df_vl_supp %>% filter(!is.na(viral_load)) %>%
  group_by(time,viral_load) %>%
  summarise(
    n_suppressed = n(),
    .groups = "drop"
  ) %>%
  mutate(time = as_factor(time) %>%  fct_relevel("Before Covid-19"),
         viral_load = as_factor(viral_load) %>%
           fct_relevel("Viral Load Suppression"))

df_vl_summary <-  df_vl_summary %>%
  group_by(time) %>%
  summarise(n = sum(n_suppressed)) %>%
  left_join(df_vl_summary,join_by(time))

df_vl_summary <- df_vl_summary  %>%
  mutate(
    proportion = n_suppressed / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  )
df_vl_summary
```

time	n	viral_load	n_suppressed	proportion	se	lower	upper
Before Covid-19	2779	Viraemia	135	0.0485786	0.0040782	0.0405854	0.0565718
Before Covid-19	2779	Viral Load Sppression	2644	0.9514214	0.0040782	0.9434282	0.9594146
After Covid-19	2780	Viraemia	135	0.0485612	0.0040767	0.0405707	0.0565516
After Covid-19	2780	Viral Load Sppression	2645	0.9514388	0.0040767	0.9434484	0.9594293

```r
ggplot(df_vl_summary, aes(x = viral_load, y = proportion, fill = time)) +
  geom_bar(
    stat = "identity",
    position = position_dodge(width = 0.7),
    width = 0.5
  ) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 0.5
  ) +
  scale_y_continuous(labels = scales::percent_format()) +
  labs(x = "Viral Load",
       y = "Proportion of individuals",
       fill = "Time",
       title = "Viral Load Levels") +

  theme_minimal()+
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
```

Viral Load Levels
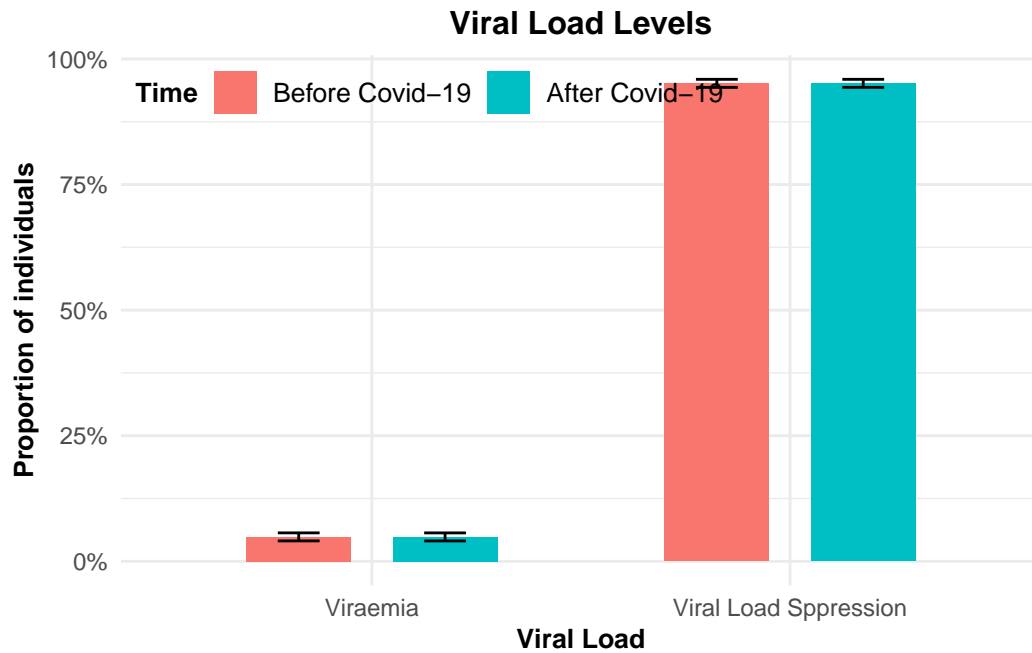
Proportion taking ART pills less frequently / in smaller amounts by Sex

```r
df6 %>% group_by(sex,artstrbc) %>%
  count()
```

sex	artstrbc	n
Female	No	1799
Female	Yes	21
Male	No	1003
Male	Yes	11

```r
df6 %>% group_by(sex,artstrac) %>%
  count()
```

sex	artstrac	n
Female	No	1775
Female	Yes	45
Male	No	985

sex	artstrac	n
Male	Yes	29

```r
df_artstr <- df6 %>%
  pivot_longer(
    cols = c(artstrbc, artstrac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_artstr_summary <- df_artstr %>%
  group_by(time,sex) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_artstr_totals <- df_artstr %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_artstr_summary <- bind_rows(df_artstr_summary, df_artstr_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
         sex= if_else(is.na(sex),"Total",sex))
```
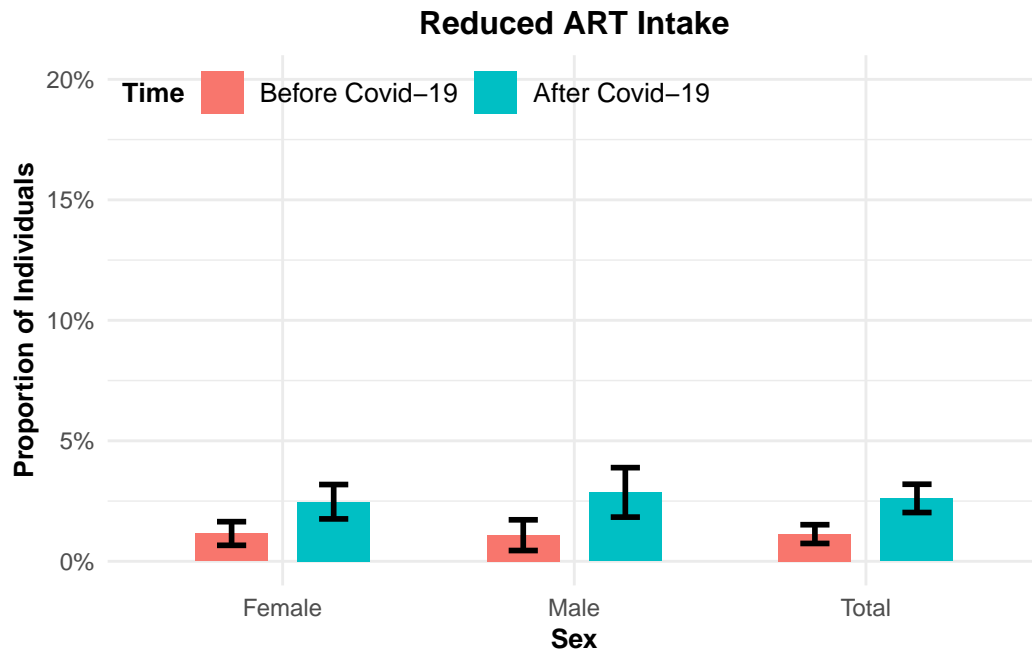
```
df_artstr_summary <-  df_artstr_summary %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    sex = as_factor(sex)
  )
```

```
reduced_art_intake_plot <- ggplot(df_artstr_summary, aes(x = sex, y = proportion, fill = tim
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20))+
  labs(
    title = "Reduced ART Intake",
    x = "Sex",
    y = "Proportion of Individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

reduced_art_intake_plot
```

Reduced ART Intake

Run out of ART before next refill by Sex

```
df6 %>% group_by(sex,artrunbc) %>%
  count()
```

sex	artrunbc	n
Female	No	1777
Female	Yes	43
Male	No	990
Male	Yes	24

```
df6 %>% group_by(sex,artrunac) %>%
  count()
```

sex	artrunac	n
Female	No	1714
Female	Yes	106
Male	No	968

sex	artrunac	n
Male	Yes	46

```r
df_artrun <- df6 %>%
  pivot_longer(
    cols = c(artrunbc, artrunac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19"),
    variable = "Run out of ART before next refill"
  )


df_artrun_summary <- df_artrun %>%
  group_by(time,sex) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_artrun_totals <- df_artrun %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )


df_artrun_totals
```

time	n_yes	n
After Covid-19	152	2834
Before Covid-19	67	2834

```
df_artrun_summary <- bind_rows(df_artrun_summary, df_artrun_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  )%>%
  mutate(time = as_factor(time) %>%
          fct_relevel("Before Covid-19"),
        sex= if_else(is.na(sex),"Total",sex))


df_artrun_summary <-  df_artrun_summary %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    sex = as_factor(sex)
  )


run_out_of_art_plot <- ggplot(df_artrun_summary, aes(x = sex, y = proportion,fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20)) +
  labs(
    title = "Run Out of ART",
    x = "Sex",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
```

```
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
run_out_of_art_plot
```

Run Out of ART

Missed Scheduled Visits by Sex

```
df6 %>% group_by(sex,hivbc) %>%
  count()
```

sex	hivbc	n
Female	No	1763
Female	Yes	57
Male	No	976
Male	Yes	38

```
df6 %>% group_by(sex,hivac) %>%
  count()
```

sex	hivac	n
Female	No	1642
Female	Yes	178
Male	No	917
Male	Yes	97

```r
df_hiv <- df6 %>%
  pivot_longer(
    cols = c(hivbc, hivac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19"),
    variable = "Missed Scheduled Visits"
  )

df_hiv_summary <- df_hiv %>%
  group_by(time,sex) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_hiv_totals <- df_hiv %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_hiv_summary <- bind_rows(df_hiv_summary, df_hiv_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  )%>%
  mutate(time = as_factor(time) %>%
```
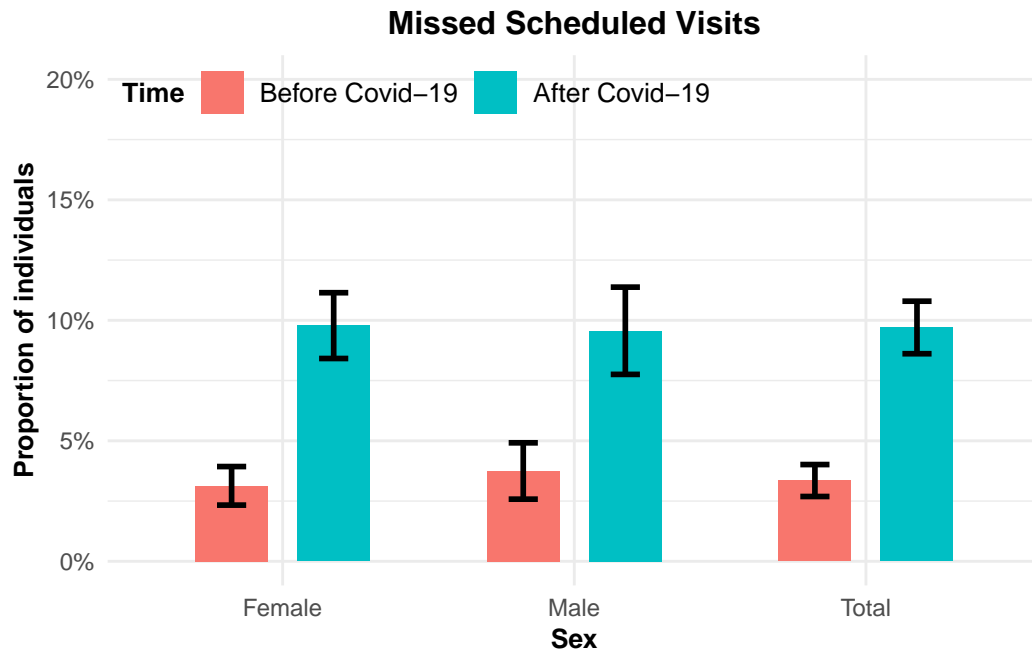
```r
        fct_relevel("Before Covid-19"),
      sex= if_else(is.na(sex),"Total",sex))



df_hiv_summary <-  df_hiv_summary %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    sex = as_factor(sex)
  )
```

```r
missed_scheduled_visit_plot <-  ggplot(df_hiv_summary, aes(x = sex, y = proportion, fill = t:
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Sex",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

missed_scheduled_visit_plot
```
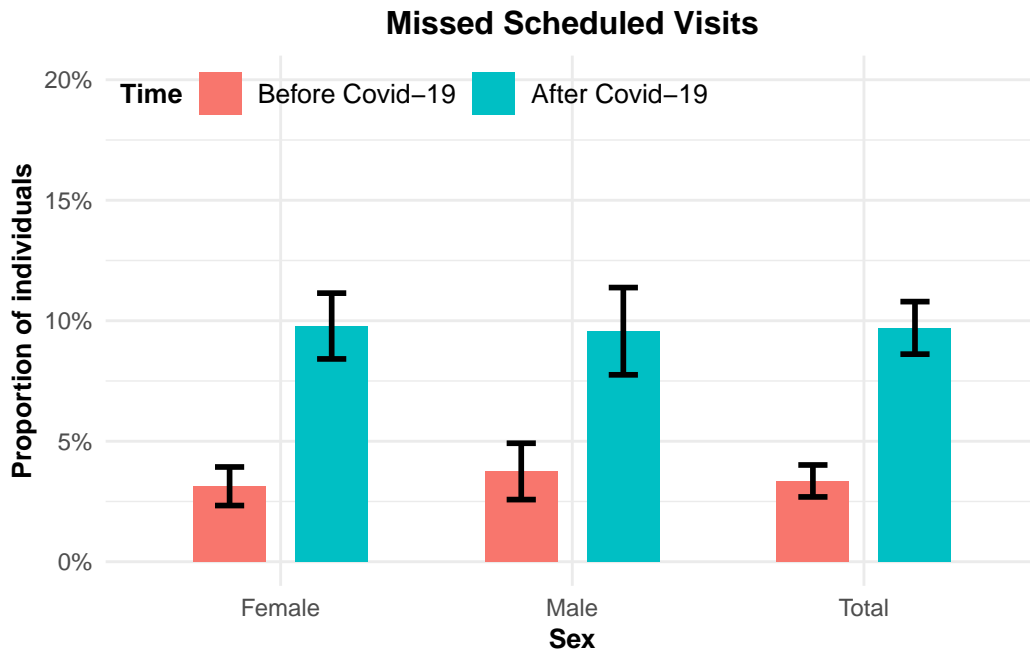
Missed Scheduled Visits

Combined Plots

```r
ps1 <- ggplot(df_hiv_summary, aes(x = sex, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Sex",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
```

```
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
ps1 ## Missed scheduled visits
```
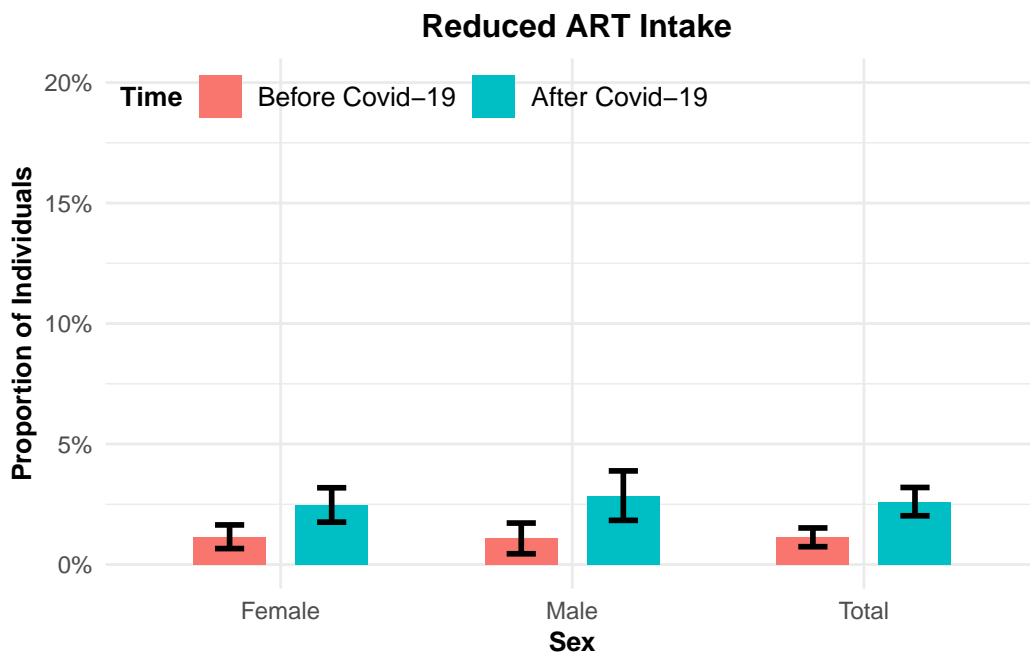
Missed Scheduled Visits


```
### Reduced pill intake
ps2 <- ggplot(df_artstr_summary, aes(x = sex, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20))+
  labs(
    title = " Reduced ART Intake",
    x = "Sex",
```

```
    y = "Proportion of Individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
   legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
ps2
```

Reduced ART Intake


```
## Run out of pills
ps3 <- ggplot(df_artrun_summary, aes(x = sex, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
```
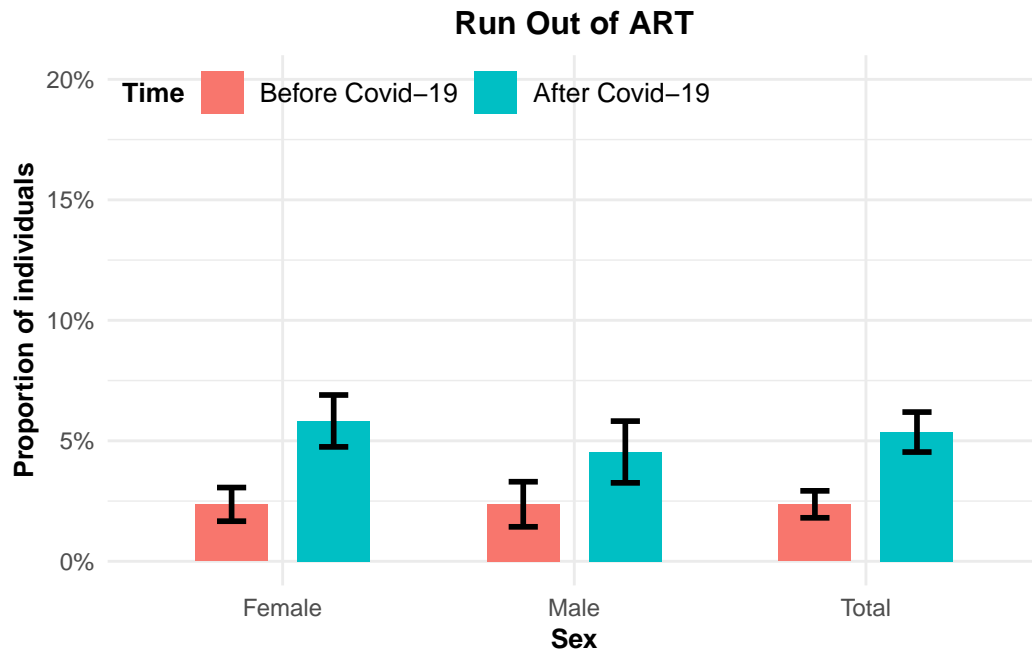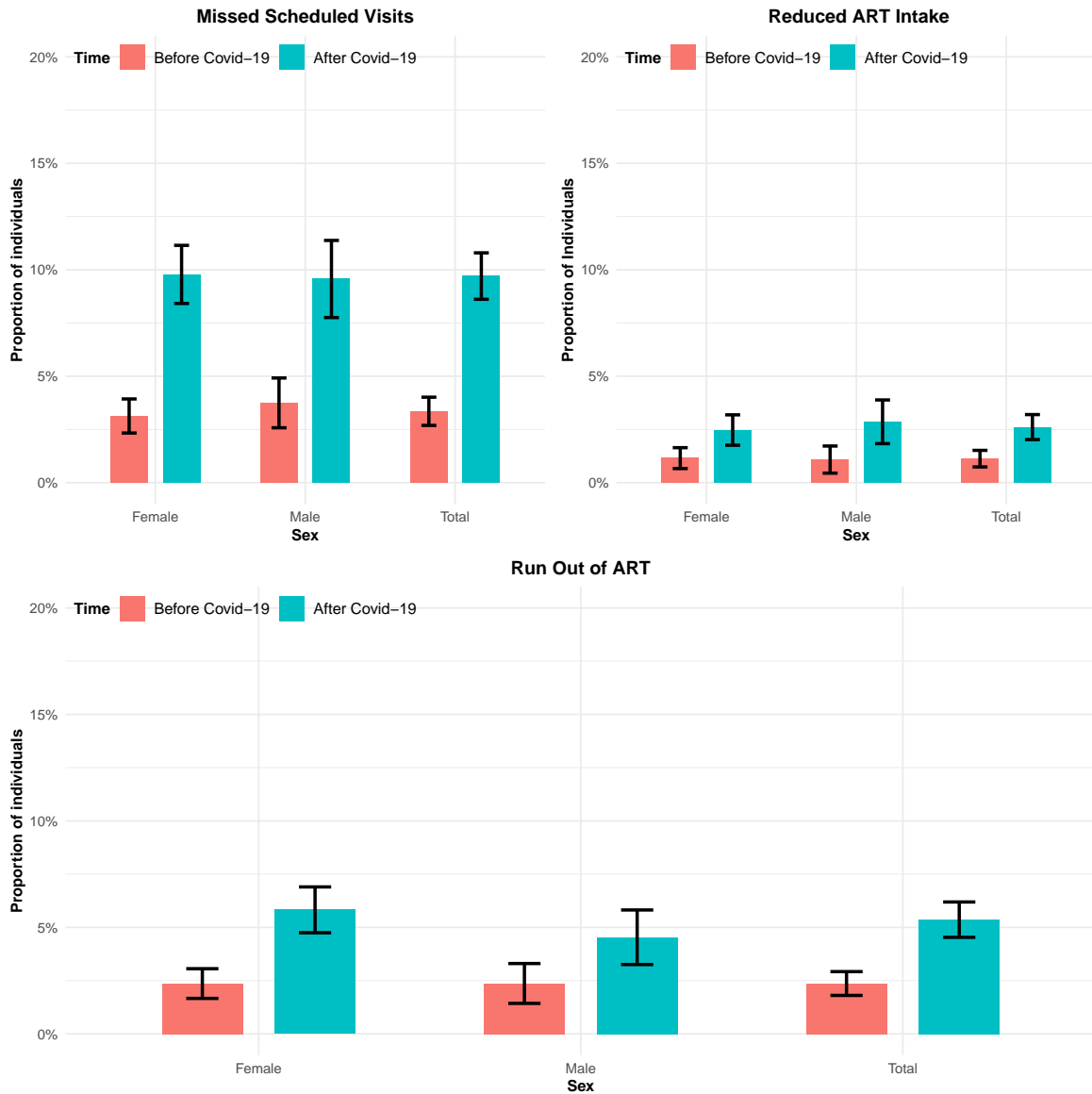
```r
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20)) +
  labs(
    title =  "Run Out of ART",
    x = "Sex",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title =  element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

ps3
```

Run Out of ART

```
### Combined plot
(ps1 + ps2)/ps3
```

Missed Scheduled Visits

Reduced ART Intake

Run Out of ART

SUBPLOTS

Community Type

```
df_com <-  rakai %>%
  select(comm_num,artrunbc,artrunac,
```

```
        hivac,hivbc,copies,new_copies,artstrac,artstrbc) %>%
  filter(hivac !=8, hivbc!=8,artrunbc!=8,artstrac!=8,artstrbc!=8,artrunac!=8) %>%
  mutate(
    community_type = case_when(
      comm_num %in% c(38,770,771,774) ~ "Fishing community",
      .default = "Inland Community") %>%
      fct_relevel("Inland Community") %>%
      ff_label("Community type"),

    hivac = if_else(hivac ==1, "Yes","No") %>%
    ff_label("Missed scheduled visit for HIV care") %>%
      as_factor(),

     hivbc = if_else(hivbc ==1,"Yes","No") %>%
    ff_label("Missed scheduled visit for HIV care") %>%
    as_factor(),

     artrunac = if_else(artrunac ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Run out of ART before next refill"),

   artrunbc = if_else(artrunbc ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Run out of ART before next refill"),

   artstrac = if_else(artstrac ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply"),

   artstrbc = if_else(artstrbc ==1,"Yes","No") %>%
    as_factor() %>%
    ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply")
  ) %>%
  select(-comm_num)
```

```
# df_com
```

Reduced ART intake by Community

```
df_com %>% group_by(community_type,artstrbc) %>%
  count()
```

community_type	artstrbc	n
Inland Community	No	1272
Inland Community	Yes	11
Fishing community	No	1530
Fishing community	Yes	21

```
df_com %>% group_by(community_type,artstrac) %>%
  count()
```

community_type	artstrac	n
Inland Community	No	1268
Inland Community	Yes	15
Fishing community	No	1492
Fishing community	Yes	59

```
df_com_artstr <- df_com %>%
  pivot_longer(
    cols = c(artstrbc, artstrac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_com_artstr_summary <- df_com_artstr %>%
  group_by(time,community_type) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )
```

```
df_com_artstr_totals <- df_com_artstr %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_com_artstr_summary <- bind_rows(df_com_artstr_summary, df_com_artstr_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
         community_type = if_else(is.na(community_type),"Total",community_type))

df_com_artstr_summary
```

time	community_type	n_yes	n	proportion	se	lower	upper
After Covid-19	Inland Community	15	1283	0.0116913	0.0030010	0.0058094	0.0175733
After Covid-19	Fishing community	59	1551	0.0380400	0.0048573	0.0285197	0.0475602
Before Covid-19	Inland Community	11	1283	0.0085737	0.0025739	0.0035287	0.0136186
Before Covid-19	Fishing community	21	1551	0.0135397	0.0029345	0.0077880	0.0192913
After Covid-19	Total	74	2834	0.0261115	0.0029955	0.0202403	0.0319827
Before Covid-19	Total	32	2834	0.0112915	0.0019848	0.0074013	0.0151816

```
reduced_art_intake_by_community_plot <- ggplot(df_com_artstr_summary, aes(x = community_type
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
```
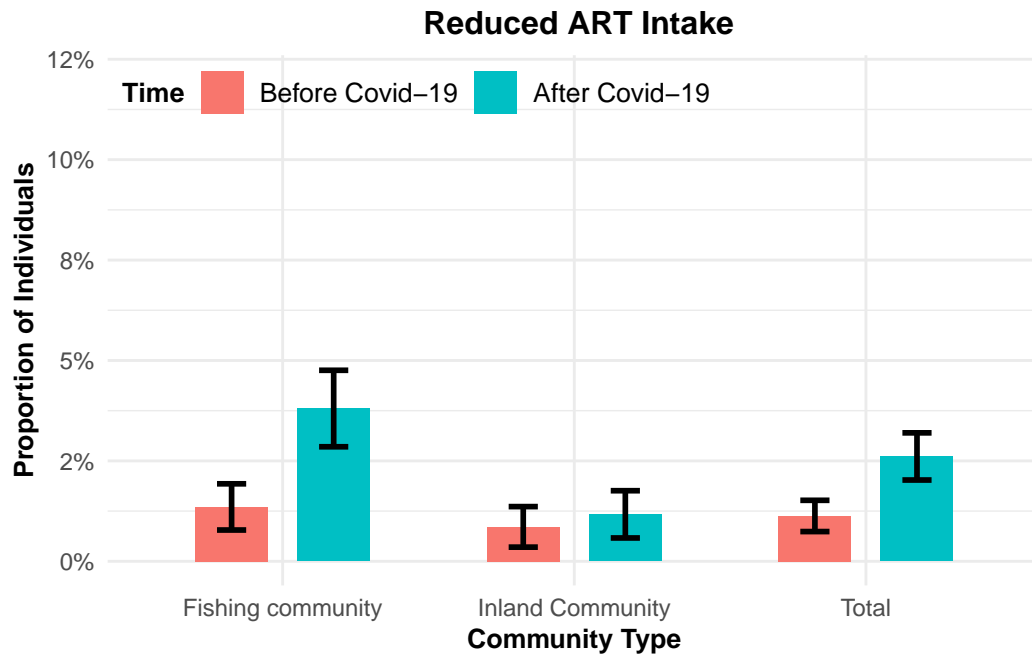
```
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.12))+
  labs(
    title = " Reduced ART Intake",
    x = "Community Type",
    y = "Proportion of Individuals",
    fill =  "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

reduced_art_intake_by_community_plot
```

Reduced ART Intake

Missed Scheduled Visits by Community

```r
df_com %>% group_by(community_type,hivbc) %>%
  count()
```

community_type	hivbc	n
Inland Community	No	1257
Inland Community	Yes	26
Fishing community	No	1482
Fishing community	Yes	69

```r
df_com %>% group_by(community_type,hivac) %>%
  count()
```

community_type	hivac	n
Inland Community	No	1198
Inland Community	Yes	85
Fishing community	No	1361

community_type	hivac	n
Fishing community	Yes	190

```r
df_com_hiv <- df_com %>%
  mutate(
    hivbc = as.character(hivbc),
    hivac = as.character(hivac)
  ) %>%
  pivot_longer(
    cols = c(hivbc, hivac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_com_hiv_summary <- df_com_hiv %>%
  group_by(time,community_type) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_com_hiv_totals <- df_com_hiv %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_com_hiv_summary <- bind_rows(df_com_hiv_summary, df_com_hiv_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  )%>%
  mutate(time = as_factor(time) %>%
```

```
        fct_relevel("Before Covid-19"),
    community_type = if_else(is.na(community_type),"Total",community_type))
```

```
df_com_hiv_summary
```

| time	community_type	n_yes	n	proportion	se	lower	upper
After Covid-19	Inland Community	85	1283	0.0662510	0.0069438	0.0526411	0.0798608
After Covid-19	Fishing community	190	1551	0.1225016	0.0083251	0.1061845	0.1388188
Before Covid-19	Inland Community	26	1283	0.0202650	0.0039338	0.0125547	0.0279753
Before Covid-19	Fishing community	69	1551	0.0444874	0.0052352	0.0342265	0.0547484
After Covid-19	Total	275	2834	0.0970360	0.0055603	0.0861377	0.1079343
Before Covid-19	Total	95	2834	0.0335215	0.0033811	0.0268946	0.0401485

```
missed_scheduled_visit_by_community_type_plot <-  ggplot(df_com_hiv_summary, aes(x = communit
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.15)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
```

```
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

missed_scheduled_visit_by_community_type_plot
```

Missed Scheduled Visits
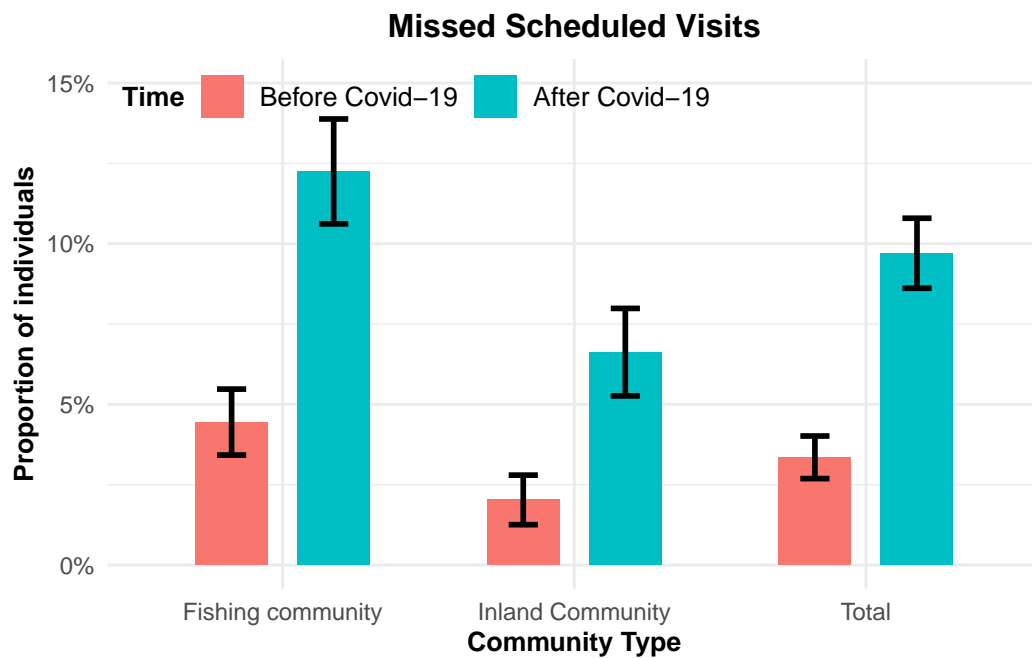
Run out of ART by Community

```
df_com %>% group_by(community_type,artrunbc) %>%
  count()
```

community_type	artrunbc	n
Inland Community	No	1253
Inland Community	Yes	30
Fishing community	No	1514

community_type	artrunbc	n
Fishing community	Yes	37

```
df_com %>% group_by(community_type,artrunac) %>%
  count()
```

community_type	artrunac	n
Inland Community	No	1225
Inland Community	Yes	58
Fishing community	No	1457
Fishing community	Yes	94

```
df_com_artrun <- df_com %>%
  mutate(
    artrunbc = as.character(artrunbc),
    artrunac = as.character(artrunac)
  ) %>%
  pivot_longer(
    cols = c(artrunbc, artrunac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_com_artrun_summary <- df_com_artrun %>%
  group_by(time,community_type) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_com_artrun_totals <- df_com_artrun %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
```

```
    .groups = "drop"
  )

df_com_artrun_summary <- bind_rows(df_com_artrun_summary, df_com_artrun_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
 mutate(time = as_factor(time) %>%
          fct_relevel("Before Covid-19"),
        community_type = if_else(is.na(community_type),"Total",community_type))



df_com_artrun_summary
```

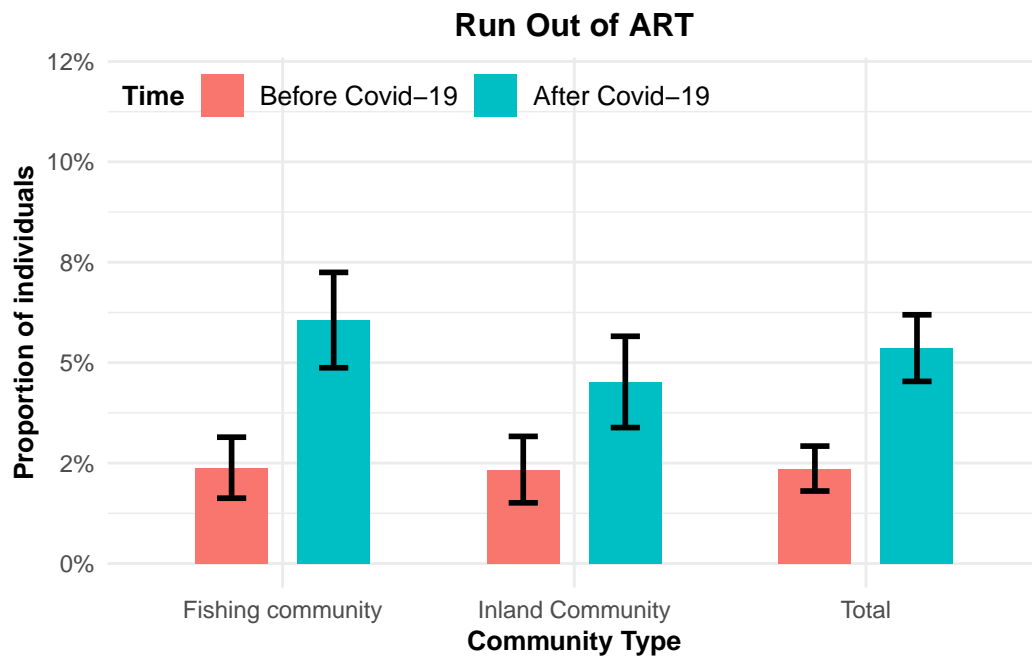| time	community_type	n_yes	n	proportion	se	lower	upper
After Covid-19	Inland Community	58	1283	0.0452065	0.0058002	0.0338382	0.0565749
After Covid-19	Fishing community	94	1551	0.0606061	0.0060587	0.0487311	0.0724810
Before Covid-19	Inland Community	30	1283	0.0233827	0.0042189	0.0151137	0.0316517
Before Covid-19	Fishing community	37	1551	0.0238556	0.0038748	0.0162610	0.0314501
After Covid-19	Total	152	2834	0.0536344	0.0042321	0.0453396	0.0619293
Before Covid-19	Total	67	2834	0.0236415	0.0028539	0.0180478	0.0292352

```
run_out_of_art_by_community_plot <- ggplot(df_com_artrun_summary, aes(x = community_type, y =
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
```

```
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.12)) +
  labs(
    title = "Run Out of ART",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
run_out_of_art_by_community_plot
```
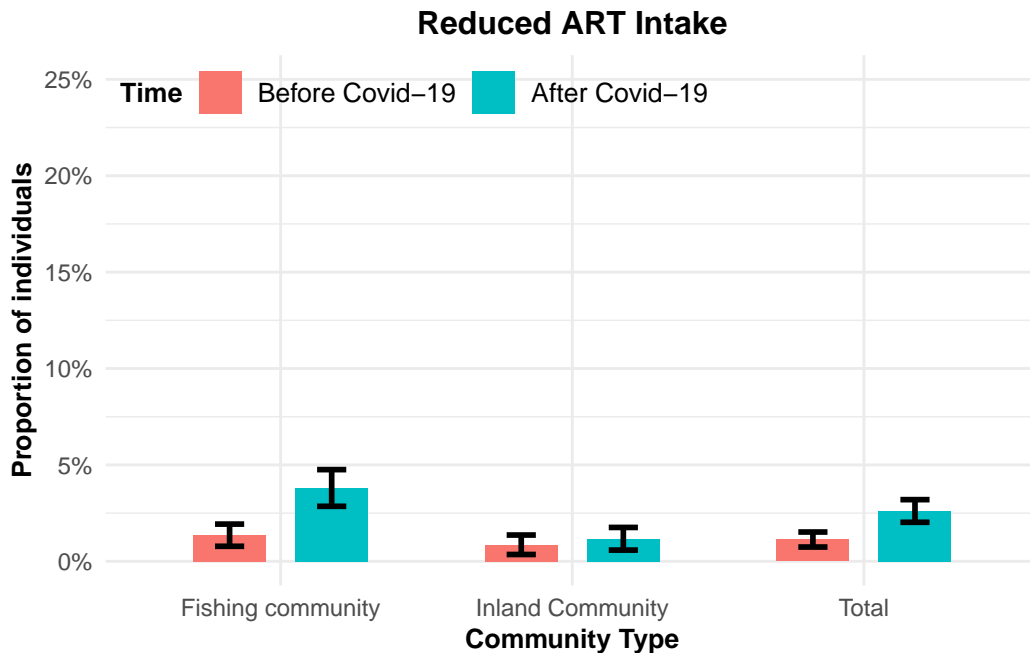
```
pc1 <- ggplot(df_com_artstr_summary, aes(x = community_type, y = proportion, fill =time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
  labs(
    title = "Reduced ART Intake",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
pc1 ##
```
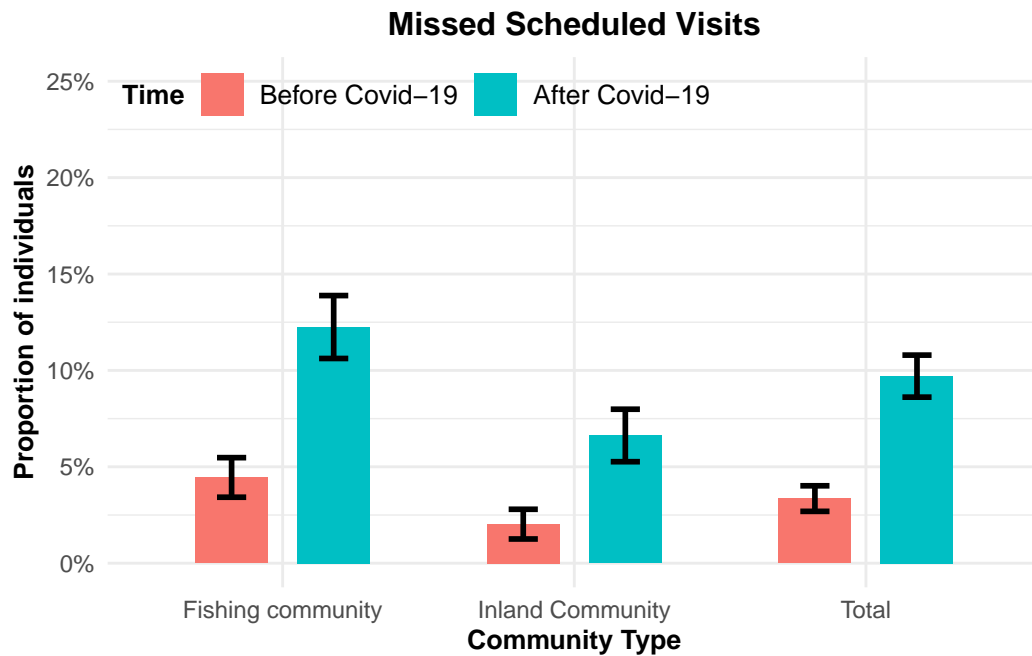
Reduced ART Intake


```
pc2 <- ggplot(df_com_hiv_summary, aes(x = community_type, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
```

```
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
pc2 ## Missed scheduled visits
```

Missed Scheduled Visits


```
## Run out of pills
pc3 <- ggplot(df_com_artrun_summary, aes(x = community_type, y = proportion, fill =time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
  labs(
    title =  "Run Out of ART",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
```
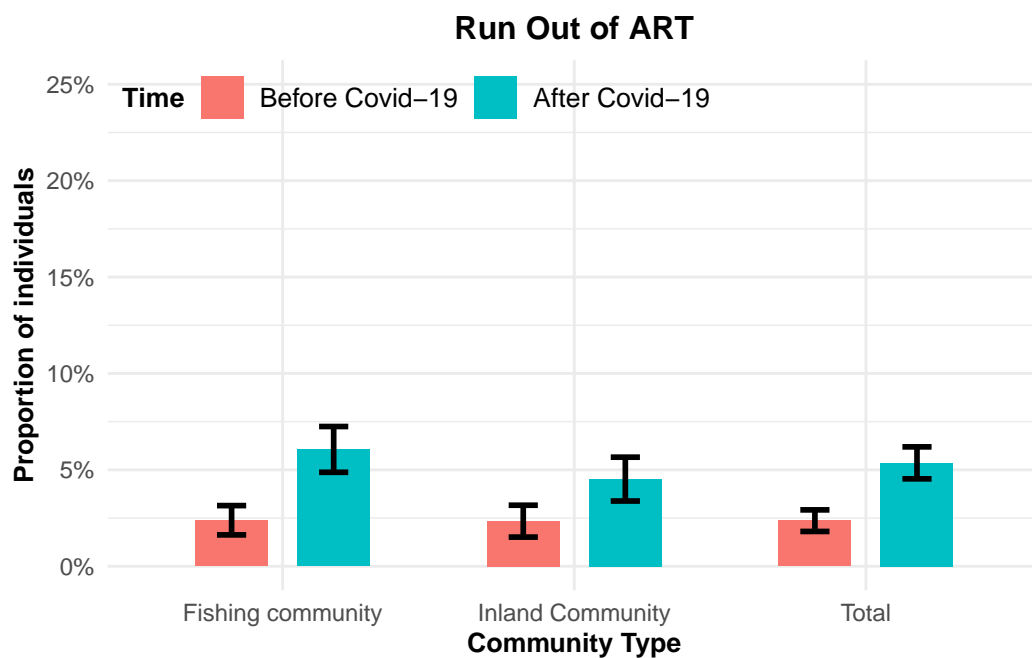
```
  theme(
    plot.title =  element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pc3
```
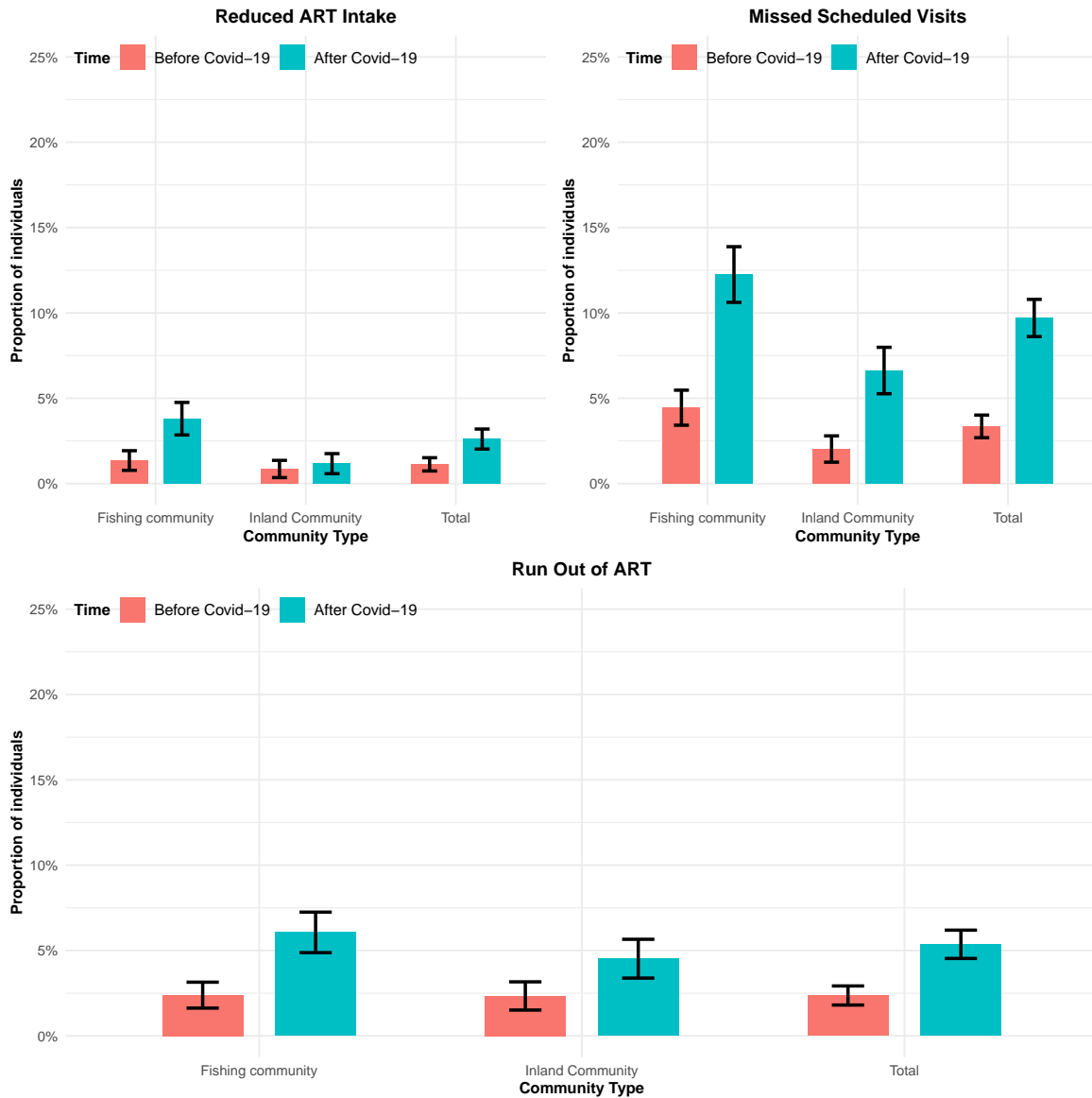
Run Out of ART


```
### Combined plot
(pc1 + pc2)/pc3
```

Mobility

```
df_mob <-  rakai %>%
  select(mobility,artrunbc,artrunac,
         hivac,hivbc,copies,new_copies,artstrac,artstrbc) %>%
  filter(hivac !=8, hivbc!=8,artrunbc!=8,artstrac!=8,artstrbc!=8,artrunac!=8) %>%
  mutate(
```

```r
  mobility = case_when(
          mobility %in% c(3,8,10) ~ "In-migrant",
          .default = "Long-term resident") %>%
          fct_relevel("In-migrant") %>%
          ff_label("Migration"),

  hivac = if_else(hivac ==1, "Yes","No") %>%
  ff_label("Missed scheduled visit for HIV care") %>%
    as_factor(),

   hivbc = if_else(hivbc ==1,"Yes","No") %>%
  ff_label("Missed scheduled visit for HIV care") %>%
  as_factor(),

   artrunac = if_else(artrunac ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Run out of ART before next refill"),

 artrunbc = if_else(artrunbc ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Run out of ART before next refill"),

  artstrac = if_else(artstrac ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply"),

  artstrbc = if_else(artstrbc ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply")
  )
```

Run Out of ART by mobility

```r
df_mob %>% group_by(mobility,artrunbc) %>%
  count()
```

mobility	artrunbc	n
In-migrant	No	610
In-migrant	Yes	22
Long-term resident	No	2157
Long-term resident	Yes	45

```r
df_mob %>% group_by(mobility,artrunac) %>%
  count()
```

mobility	artrunac	n
In-migrant	No	582
In-migrant	Yes	50
Long-term resident	No	2100
Long-term resident	Yes	102

```r
df_mob_artrun <- df_mob %>%
  mutate(
    artrunbc = as.character(artrunbc),
    artrunac = as.character(artrunac)
  ) %>%
  pivot_longer(
    cols = c(artrunbc, artrunac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_mob_artrun_summary <- df_mob_artrun %>%
  group_by(time,mobility) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_artrun_totals <- df_mob_artrun %>%
  group_by(time) %>%
```

```
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_artrun_summary <- bind_rows(df_mob_artrun_summary, df_mob_artrun_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
 mutate(time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
         mobility = if_else(is.na(mobility),"Total",mobility))




df_mob_artrun_summary
```

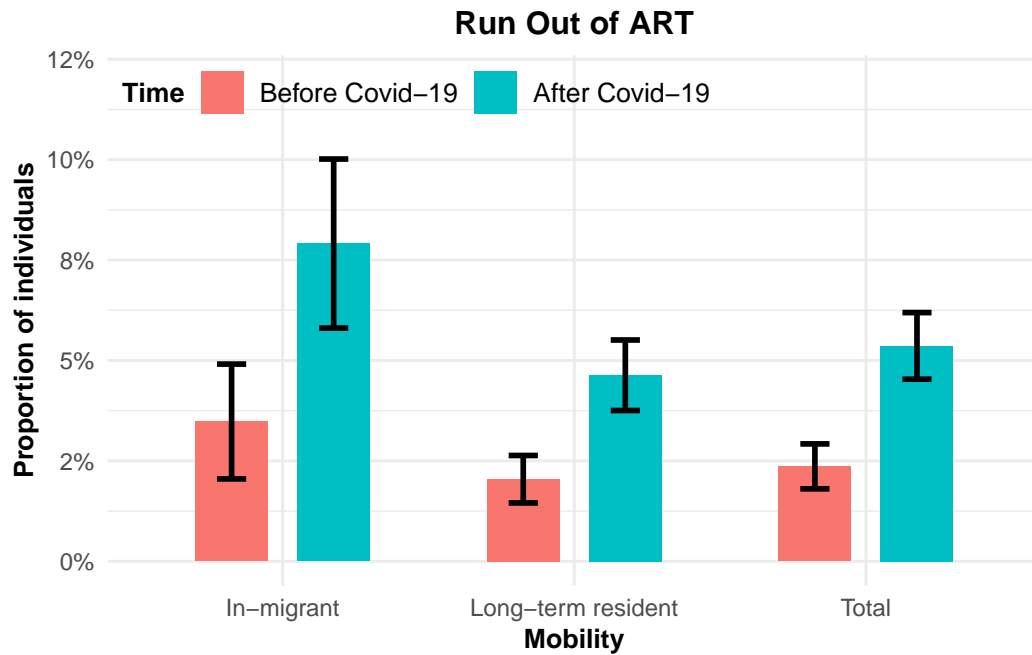| time	mobility	n_yes	n	proportion	se	lower	upper
After Covid-19	In-migrant	50	632	0.0791139	0.0107367	0.0580700	0.1001579
After Covid-19	Long-term resident	102	2202	0.0463215	0.0044790	0.0375426	0.0551004
Before Covid-19	In-migrant	22	632	0.0348101	0.0072912	0.0205193	0.0491009
Before Covid-19	Long-term resident	45	2202	0.0204360	0.0030151	0.0145263	0.0263456
After Covid-19	Total	152	2834	0.0536344	0.0042321	0.0453396	0.0619293
Before Covid-19	Total	67	2834	0.0236415	0.0028539	0.0180478	0.0292352

```
run_out_of_art_by_mobility_plot <- ggplot(df_mob_artrun_summary, aes(x = mobility, y = propor
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
```

```
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.12)) +
  labs(
    title = "Run Out of ART",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
run_out_of_art_by_mobility_plot
```

Run Out of ART

reduced ART Intake by mobility

```r
df_mob %>% group_by(mobility,artstrbc) %>%
  count()
```

mobility	artstrbc	n
In-migrant	No	625
In-migrant	Yes	7
Long-term resident	No	2177
Long-term resident	Yes	25

```r
df_mob %>% group_by(mobility,artstrac) %>%
  count()
```

mobility	artstrac	n
In-migrant	No	611
In-migrant	Yes	21
Long-term resident	No	2149

mobility	artstrac	n
Long-term resident	Yes	53

```r
df_mob_artstr <- df_mob %>%
  pivot_longer(
    cols = c(artstrbc, artstrac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_mob_artstr_summary <- df_mob_artstr %>%
  group_by(time,mobility) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_artstr_totals <- df_mob_artstr %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_artstr_summary <- bind_rows(df_mob_artstr_summary, df_mob_artstr_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
         mobility = if_else(is.na(mobility),"Total",mobility))

df_mob_artstr_summary
```
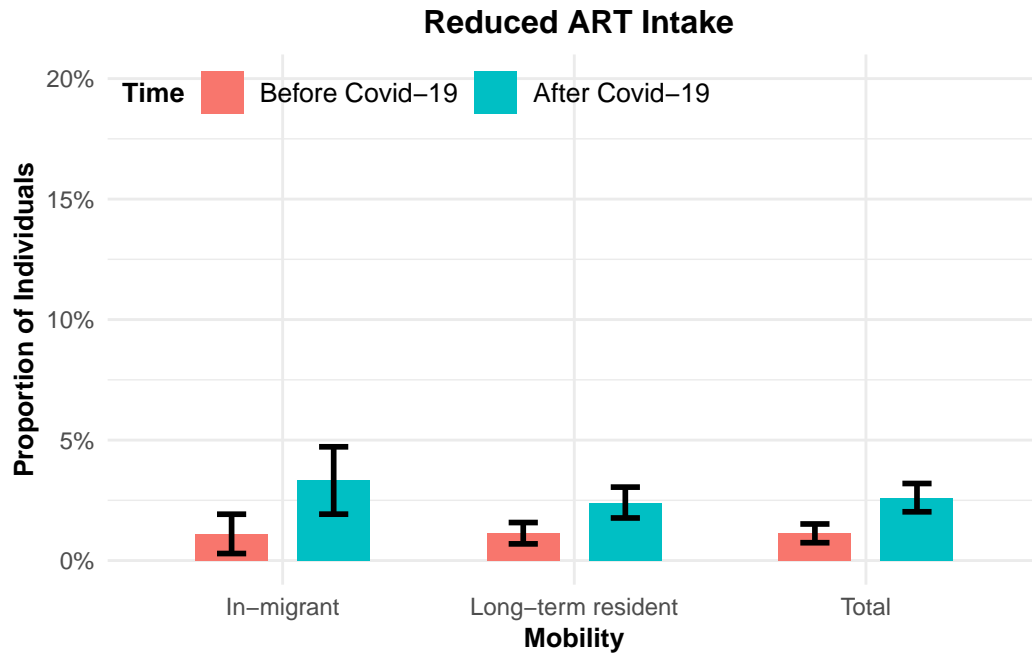
time	mobility	n__yes	n	proportion	se	lower	upper
After Covid-19	In-migrant	21	632	0.0332278	0.0071294	0.0192542	0.0472015
After Covid-19	Long-term resident	53	2202	0.0240690	0.0032661	0.0176675	0.0304706
Before Covid-19	In-migrant	7	632	0.0110759	0.0041631	0.0029163	0.0192356
Before Covid-19	Long-term resident	25	2202	0.0113533	0.0022577	0.0069282	0.0157785
After Covid-19	Total	74	2834	0.0261115	0.0029955	0.0202403	0.0319827
Before Covid-19	Total	32	2834	0.0112915	0.0019848	0.0074013	0.0151816

```r
reduced_art_intake_by_mobility_plot <- ggplot(df_mob_artstr_summary, aes(x = mobility, y = pr
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.20))+
  labs(
    title = " Reduced ART Intake",
    x = "Mobility",
    y = "Proportion of Individuals",
    fill =  "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
```

```
reduced_art_intake_by_mobility_plot
```

Reduced ART Intake

Missed scheduled visits by mobility

```
df_mob %>% group_by(mobility,hivbc) %>%
  count()
```

mobility	hivbc	n
In-migrant	No	595
In-migrant	Yes	37
Long-term resident	No	2144
Long-term resident	Yes	58

```
df_mob %>% group_by(mobility,hivac) %>%
  count()
```

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mobility	hivac	n
In-migrant	No	534
In-migrant	Yes	98
Long-term resident	No	2025
Long-term resident	Yes	177

```r
df_mob_hiv <- df_mob %>%
  mutate(
    hivbc = as.character(hivbc),
    hivac = as.character(hivac)
  ) %>%
  pivot_longer(
    cols = c(hivbc, hivac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_mob_hiv_summary <- df_mob_hiv %>%
  group_by(time,mobility) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_hiv_totals <- df_mob_hiv %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_mob_hiv_summary <- bind_rows(df_mob_hiv_summary, df_mob_hiv_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
```

```
    upper = proportion + 1.96 * se
  )%>%
  mutate(time = as_factor(time) %>%
            fct_relevel("Before Covid-19"),
        mobility = if_else(is.na(mobility),"Total",mobility))
```

```
df_com_hiv_summary
```

time	community_type	n_yes	n	proportion	se	lower	upper
After Covid-19	Inland Community	85	1283	0.0662510	0.0069438	0.0526411	0.0798608
After Covid-19	Fishing community	190	1551	0.1225016	0.0083251	0.1061845	0.1388188
Before Covid-19	Inland Community	26	1283	0.0202650	0.0039338	0.0125547	0.0279753
Before Covid-19	Fishing community	69	1551	0.0444874	0.0052352	0.0342265	0.0547484
After Covid-19	Total	275	2834	0.0970360	0.0055603	0.0861377	0.1079343
Before Covid-19	Total	95	2834	0.0335215	0.0033811	0.0268946	0.0401485

```
missed_scheduled_visit_by_mobility_plot <-  ggplot(df_mob_hiv_summary, aes(x = mobility, y =
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.2)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
```
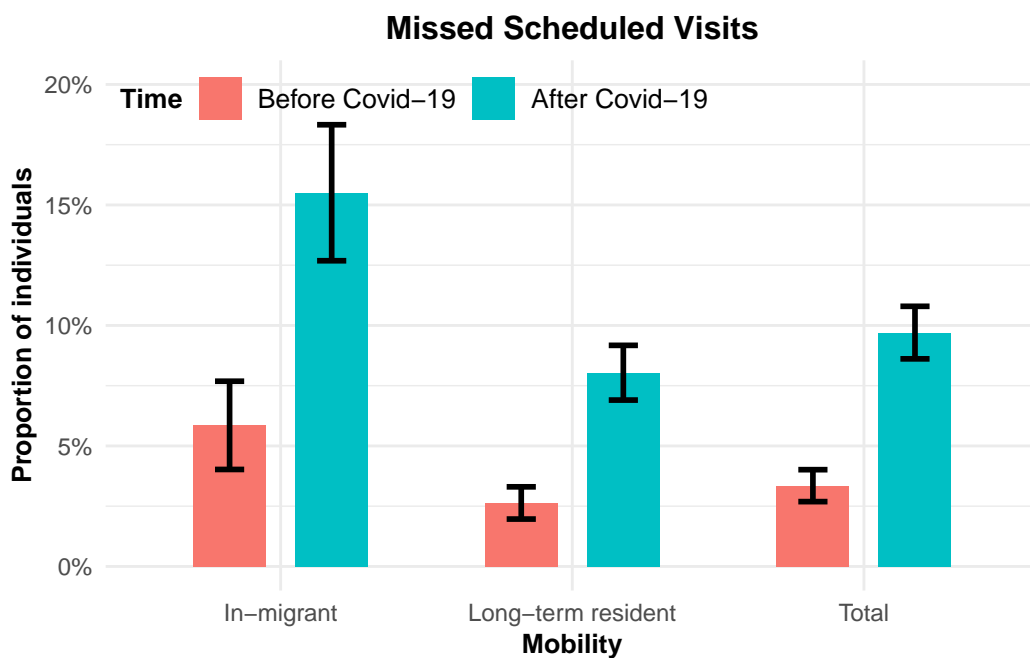
```
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

missed_scheduled_visit_by_mobility_plot
```
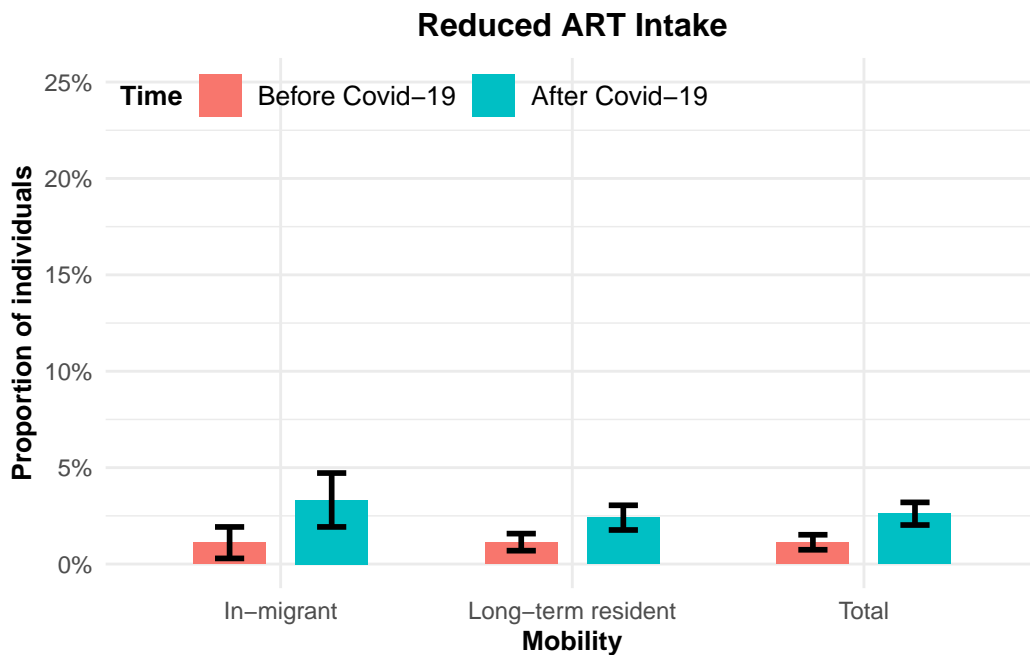


```
pm1 <- ggplot(df_mob_artstr_summary, aes(x = mobility, y = proportion, fill =time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
```

```
  labs(
    title = "Reduced ART Intake",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
pm1 ##
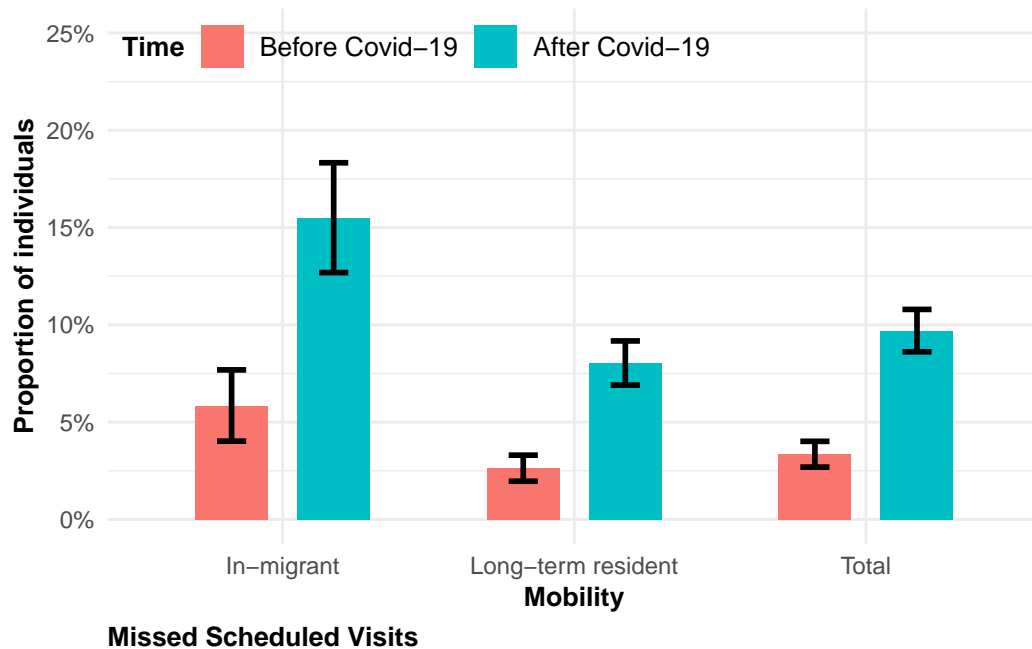```

## Reduced ART Intake



```
pm2 <- ggplot(df_mob_hiv_summary, aes(x = mobility, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
```

```
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
  labs(
    caption = "Missed Scheduled Visits",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.caption = element_text(hjust = 0, face = "bold", size = 10),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
pm2 ## Missed scheduled vis
```
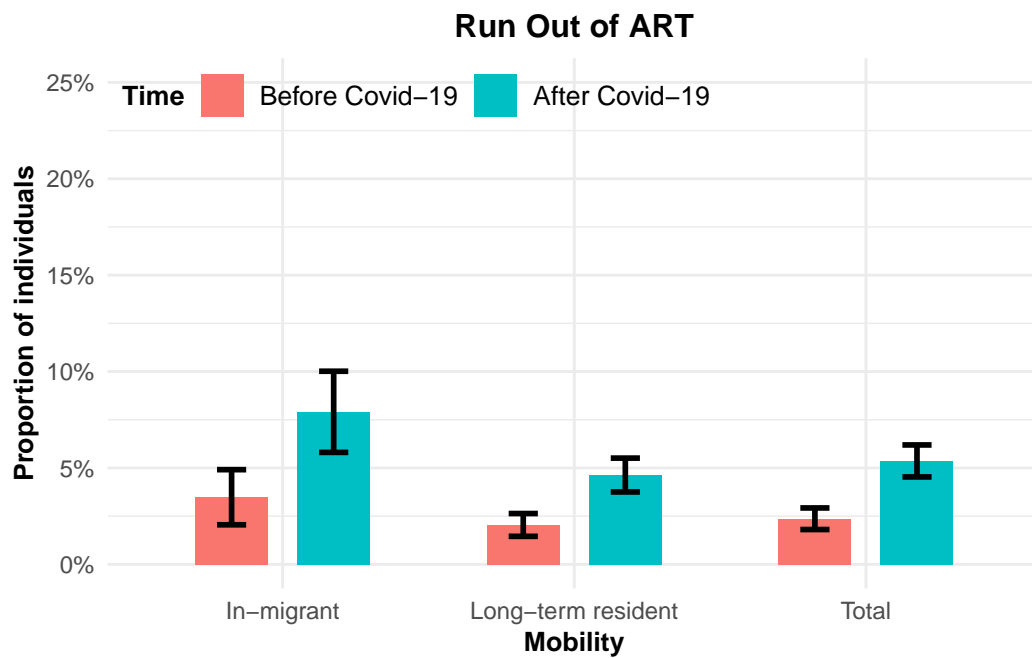
Missed Scheduled Visits

```r
pm3 <- ggplot(df_mob_artrun_summary, aes(x = mobility, y = proportion, fill =time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1),limits = c(0, 0.25)) +
  labs(
    title =  "Run Out of ART",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title =  element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
```

```
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pm3
```
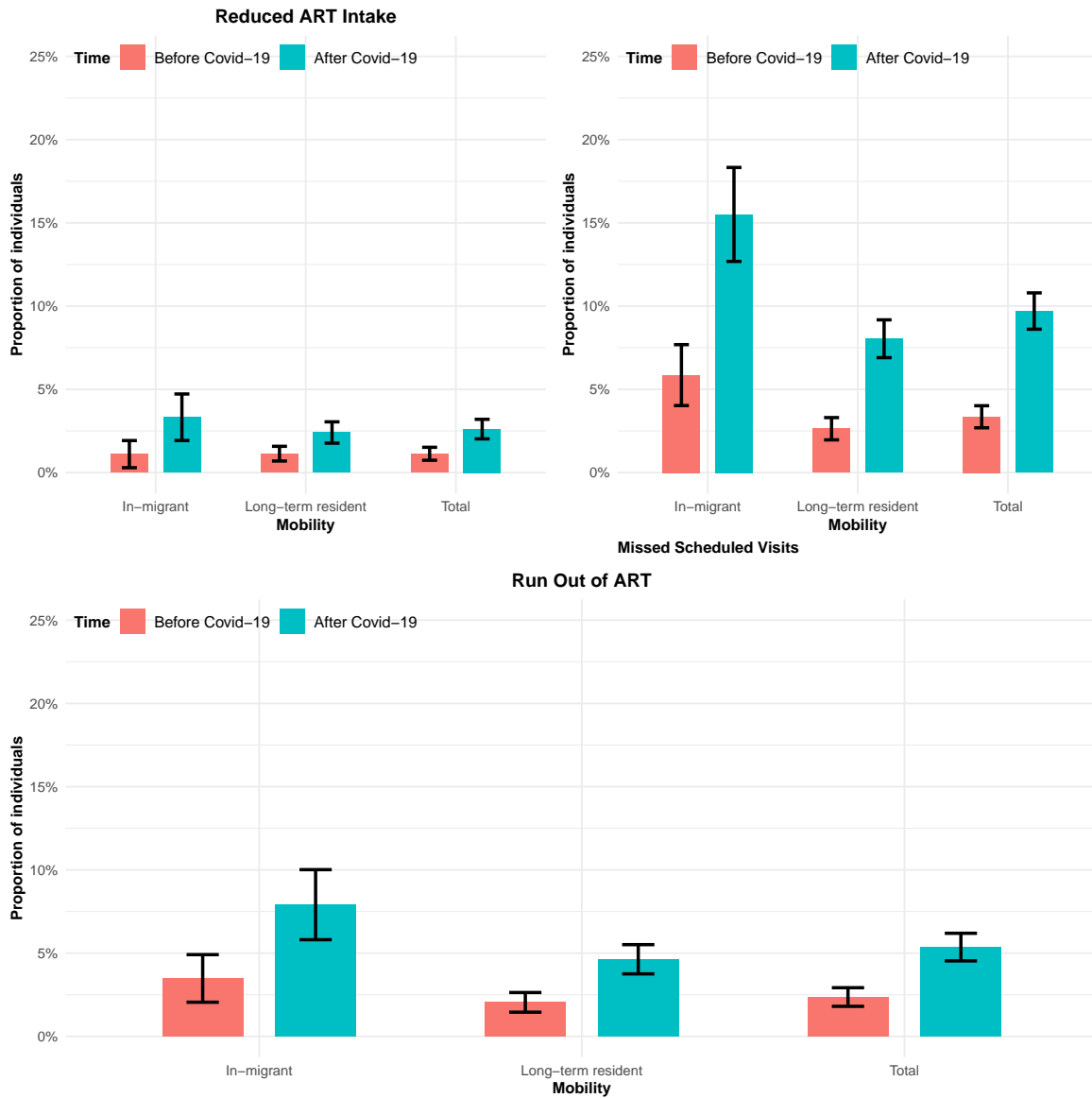
Run Out of ART


```
### Combined plot
(pm1 + pm2)/pm3
```

Age Categories

```
df_age <-  rakai %>%
  select(ageyrs,artrunbc,artrunac,
         hivac,hivbc,copies,new_copies,artstrac,artstrbc) %>%
  filter(hivac !=8, hivbc!=8,artrunbc!=8,artstrac!=8,artstrbc!=8,artrunac!=8) %>%
  mutate(
```

```r
    age_cat = case_when(
                        ageyrs < 30 ~ "<30",
                        ageyrs >= 30 & ageyrs <= 39 ~  "30-39",
                        ageyrs >=40 & ageyrs <= 49 ~ "40-49") %>%
        fct_relevel("<30") %>%
        ff_label("Age group"),

  hivac = if_else(hivac ==1, "Yes","No") %>%
  ff_label("Missed scheduled visit for HIV care") %>%
    as_factor(),

   hivbc = if_else(hivbc ==1,"Yes","No") %>%
  ff_label("Missed scheduled visit for HIV care") %>%
  as_factor(),

   artrunac = if_else(artrunac ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Run out of ART before next refill"),

 artrunbc = if_else(artrunbc ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Run out of ART before next refill"),

 artstrac = if_else(artstrac ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply"),

 artstrbc = if_else(artstrbc ==1,"Yes","No") %>%
  as_factor() %>%
  ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply")
  ) %>%
 select(-ageyrs)
```

```r
# df_age
```

Run out of ART by Age Category

```
df_age %>% group_by(age_cat,artrunbc) %>%
  count()
```

age_cat	artrunbc	n
<30	No	421
<30	Yes	12
30-39	No	1198
30-39	Yes	31
40-49	No	1148
40-49	Yes	24

```
df_age %>% group_by(age_cat,artrunac) %>%
  count()
```

age_cat	artrunac	n
<30	No	401
<30	Yes	32
30-39	No	1158
30-39	Yes	71
40-49	No	1123
40-49	Yes	49

```
df_age_artrun <- df_age %>%
  mutate(
    artrunbc = as.character(artrunbc),
    artrunac = as.character(artrunac)
  ) %>%
  pivot_longer(
    cols = c(artrunbc, artrunac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_age_artrun_summary <- df_age_artrun %>%
  group_by(time, age_cat) %>%
```

```
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_artrun_totals <- df_age_artrun %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_artrun_summary <- bind_rows(df_age_artrun_summary, df_age_artrun_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    age_cat = if_else(is.na(age_cat), "Total", age_cat)
  )

df_age_artrun_summary
```

time	age_cat	n_yes	n	proportion	se	lower	upper
After Covid-19	<30	32	433	0.0739030	0.0125723	0.0492613	0.0985447
After Covid-19	30-39	71	1229	0.0577705	0.0066551	0.0447265	0.0708146
After Covid-19	40-49	49	1172	0.0418089	0.0058465	0.0303497	0.0532680
Before Covid-19	<30	12	433	0.0277136	0.0078886	0.0122520	0.0431753
Before Covid-19	30-39	31	1229	0.0252238	0.0044728	0.0164570	0.0339905
Before Covid-19	40-49	24	1172	0.0204778	0.0041370	0.0123693	0.0285863
After Covid-19	Total	152	2834	0.0536344	0.0042321	0.0453396	0.0619293

time	age_cat	n_yes	n	proportion	se	lower	upper
Before Covid-19	Total	67	2834	0.0236415	0.0028539	0.0180478	0.0292352

```
run_out_of_art_by_age_plot <- ggplot(df_age_artrun_summary, aes(x = age_cat, y = proportion,
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.16)) +
  labs(
    title = "Run Out of ART",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
run_out_of_art_by_age_plot
```

Run Out of ART
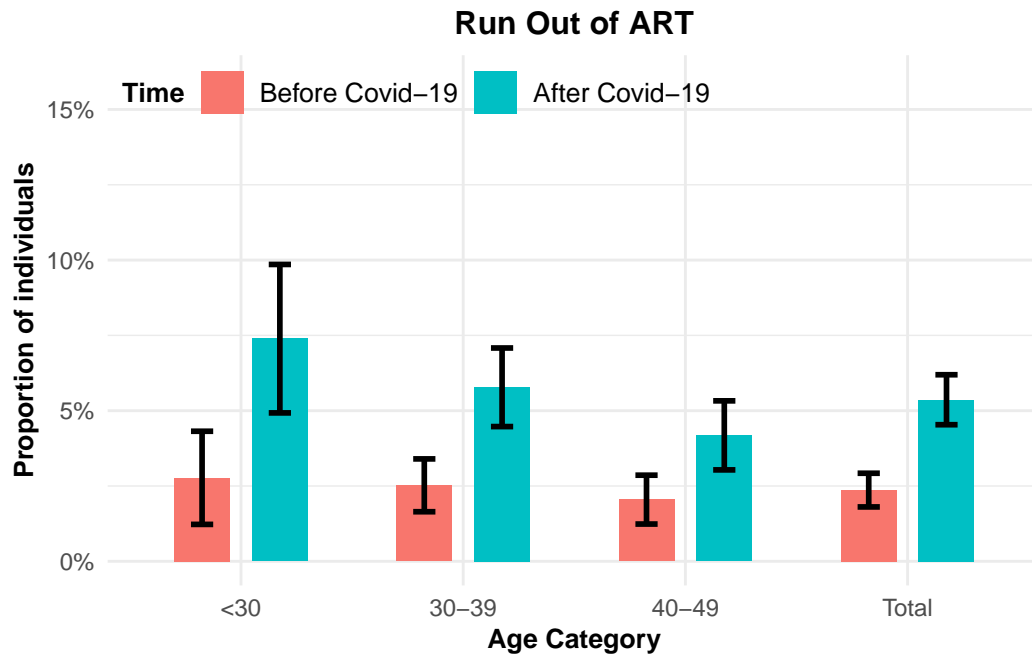
Missed Scheduled Visits by Age Category

```
df_age %>% group_by(age_cat,hivbc) %>%
  count()
```

age_cat	hivbc	n
<30	No	411
<30	Yes	22
30-39	No	1186
30-39	Yes	43
40-49	No	1142
40-49	Yes	30

```
df_age %>% group_by(age_cat,hivac) %>%
  count()
```

age_cat	hivac	n
<30	No	383

age_cat	hivac	n
<30	Yes	50
30-39	No	1095
30-39	Yes	134
40-49	No	1081
40-49	Yes	91

```r
df_age_hiv <- df_age %>%
  mutate(
    hivbc = as.character(hivbc),
    hivac = as.character(hivac)
  ) %>%
  pivot_longer(
    cols = c(hivbc, hivac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_age_hiv_summary <- df_age_hiv %>%
  group_by(time, age_cat) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_hiv_totals <- df_age_hiv %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_hiv_summary <- bind_rows(df_age_hiv_summary, df_age_hiv_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
```

```
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    age_cat = if_else(is.na(age_cat), "Total", age_cat)
  )

df_age_hiv_summary
```

time	age_cat	n_yes	n	proportion	se	lower	upper
After Covid-19	<30	50	433	0.1154734	0.0153586	0.0853705	0.1455764
After Covid-19	30-39	134	1229	0.1090317	0.0088906	0.0916061	0.1264573
After Covid-19	40-49	91	1172	0.0776451	0.0078170	0.0623237	0.0929664
Before Covid-19	<30	22	433	0.0508083	0.0105536	0.0301233	0.0714934
Before Covid-19	30-39	43	1229	0.0349878	0.0052414	0.0247146	0.0452610
Before Covid-19	40-49	30	1172	0.0255973	0.0046132	0.0165554	0.0346391
After Covid-19	Total	275	2834	0.0970360	0.0055603	0.0861377	0.1079343
Before Covid-19	Total	95	2834	0.0335215	0.0033811	0.0268946	0.0401485

```
missed_scheduled_visit_by_age_plot <- ggplot(df_age_hiv_summary, aes(x = age_cat, y = propor
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.16)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
```
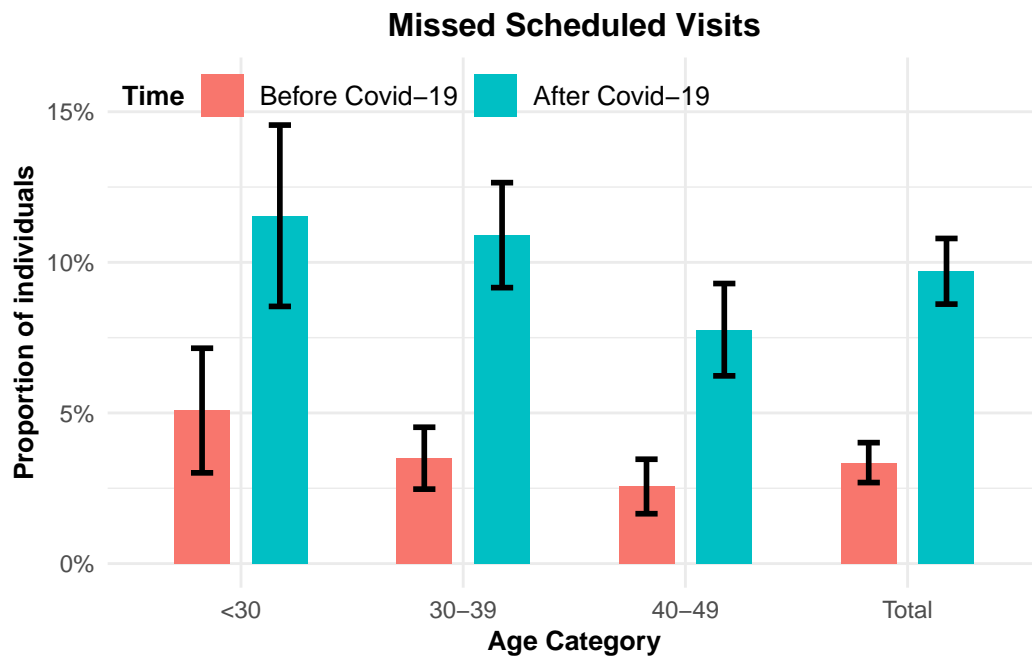
```
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

missed_scheduled_visit_by_age_plot
```


Reduced ART Intake by Age Category

```
df_age %>% group_by(age_cat,artstrbc) %>%
  count()
```

age_cat	artstrbc	n
<30	No	426
<30	Yes	7
30-39	No	1213
30-39	Yes	16
40-49	No	1163
40-49	Yes	9

```r
df_age %>% group_by(age_cat,artstrac) %>%
  count()
```

age_cat	artstrac	n
<30	No	418
<30	Yes	15
30-39	No	1190
30-39	Yes	39
40-49	No	1152
40-49	Yes	20

```r
df_age_artstr <- df_age %>%
  pivot_longer(
    cols = c(artstrbc, artstrac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_age_artstr_summary <- df_age_artstr %>%
  group_by(time, age_cat) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_artstr_totals <- df_age_artstr %>%
  group_by(time) %>%
```

```
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_age_artstr_summary <- bind_rows(df_age_artstr_summary, df_age_artstr_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    age_cat = if_else(is.na(age_cat), "Total", age_cat)
  )


df_age_artstr_summary
```

time	age_cat	n_yes	n	proportion	se	lower	upper
After Covid-19	<30	15	433	0.0346420	0.0087882	0.0174171	0.0518670
After Covid-19	30-39	39	1229	0.0317331	0.0050001	0.0219329	0.0415333
After Covid-19	40-49	20	1172	0.0170648	0.0037831	0.0096499	0.0244798
Before Covid-19	<30	7	433	0.0161663	0.0060607	0.0042873	0.0280452
Before Covid-19	30-39	16	1229	0.0130187	0.0032334	0.0066812	0.0193562
Before Covid-19	40-49	9	1172	0.0076792	0.0025499	0.0026814	0.0126769
After Covid-19	Total	74	2834	0.0261115	0.0029955	0.0202403	0.0319827
Before Covid-19	Total	32	2834	0.0112915	0.0019848	0.0074013	0.0151816

```
reduced_art_intake_by_age_plot <- ggplot(df_age_artstr_summary, aes(x = age_cat, y = proport
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
```
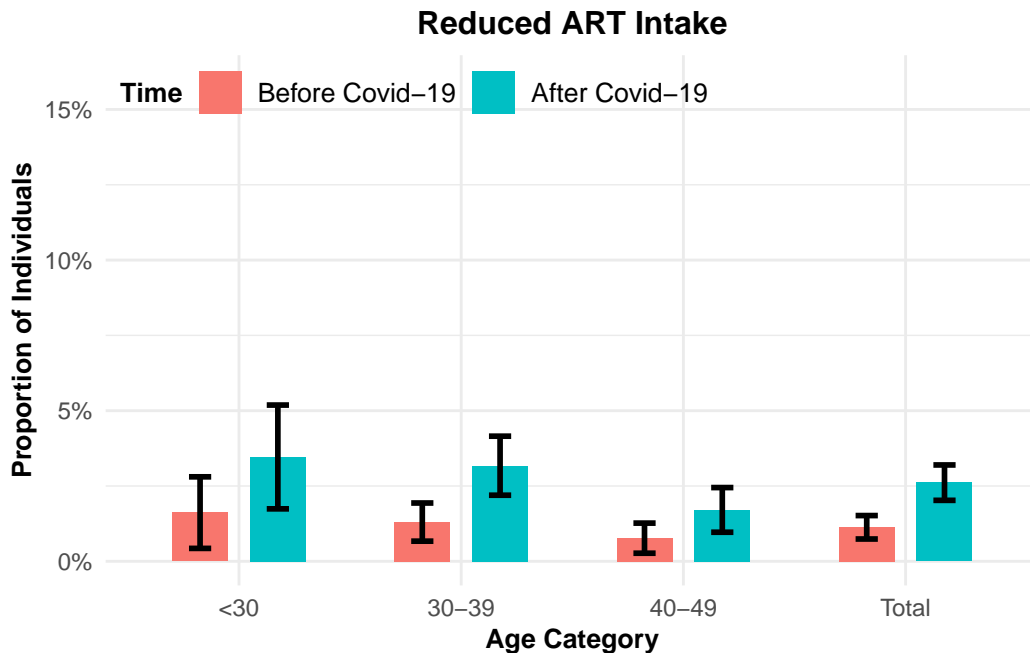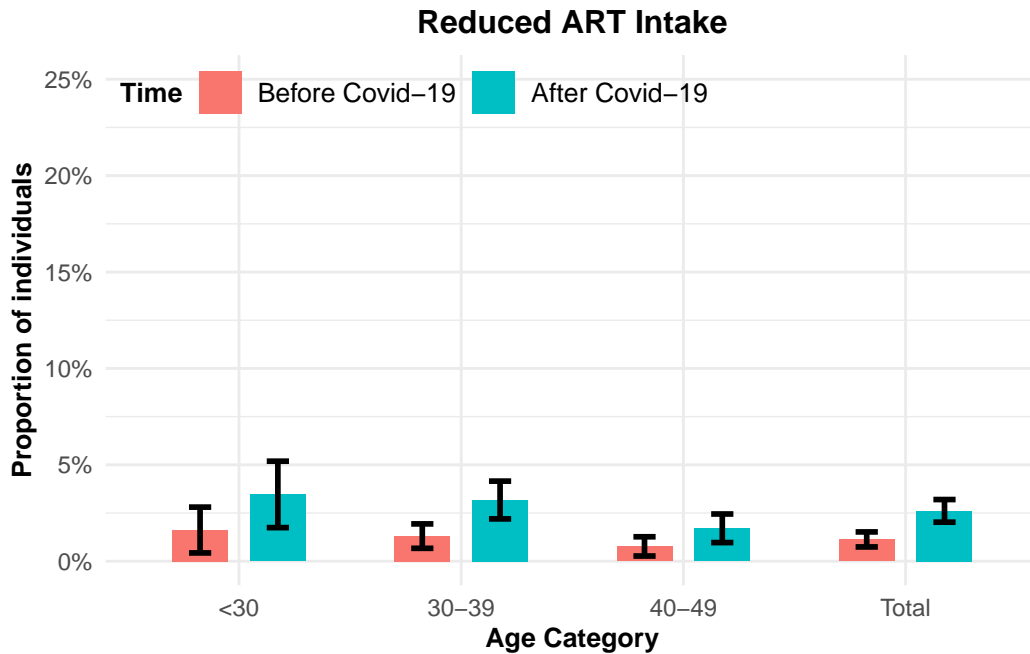
```
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.16)) +
  labs(
    title = "Reduced ART Intake",
    x = "Age Category",
    y = "Proportion of Individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

reduced_art_intake_by_age_plot
```

Reduced ART Intake


```
pa1 <- ggplot(df_age_artstr_summary, aes(x = age_cat, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Reduced ART Intake",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
```
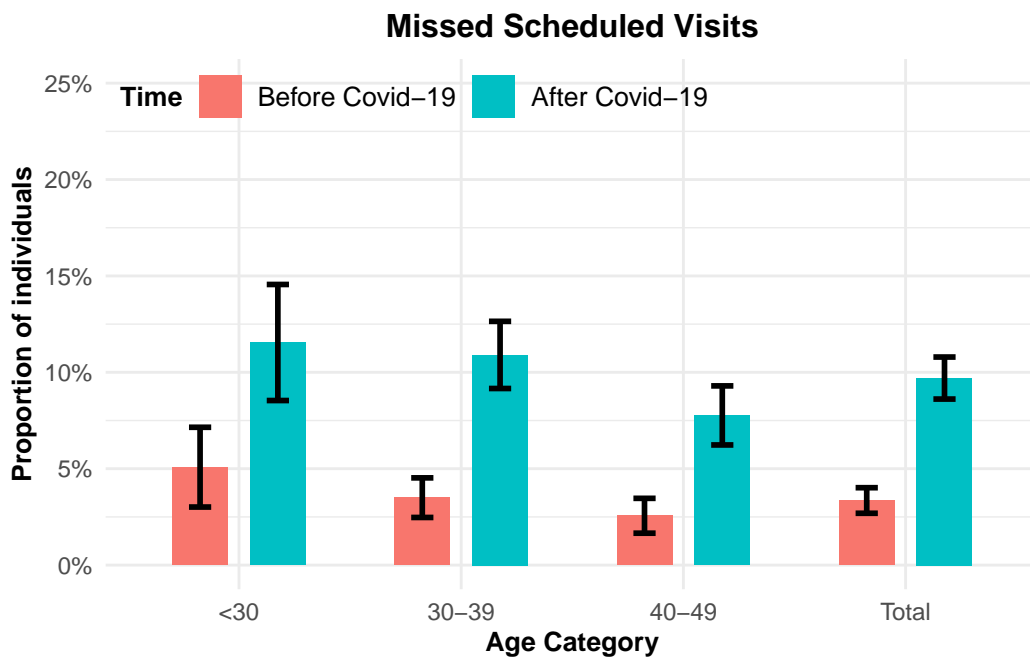
```
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )
pa1
```

Reduced ART Intake


```
pa2 <- ggplot(df_age_hiv_summary, aes(x = age_cat, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
```

```
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pa2
```
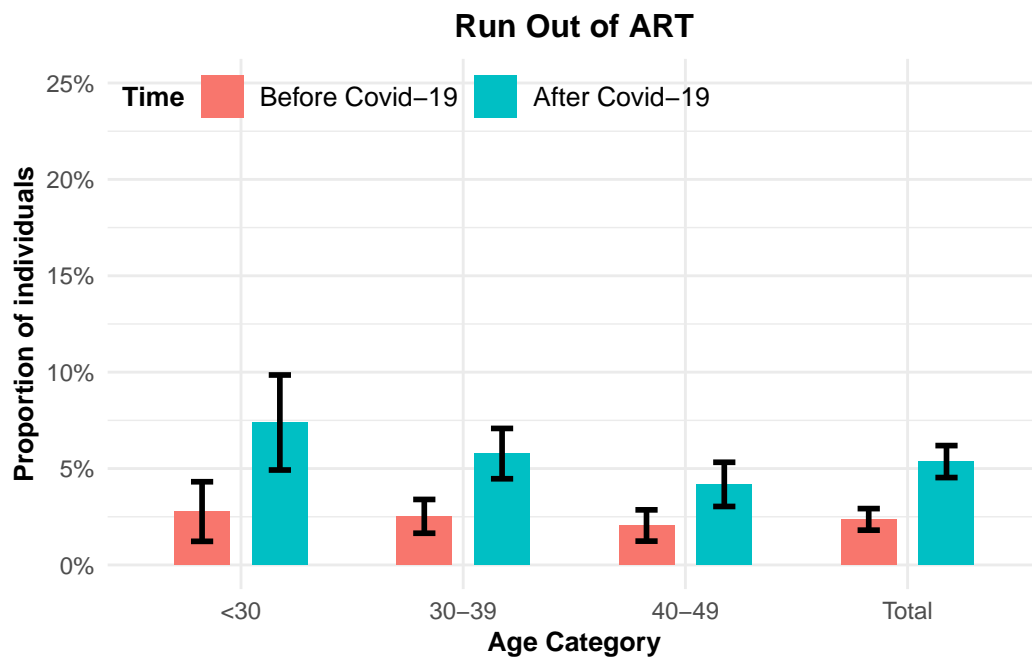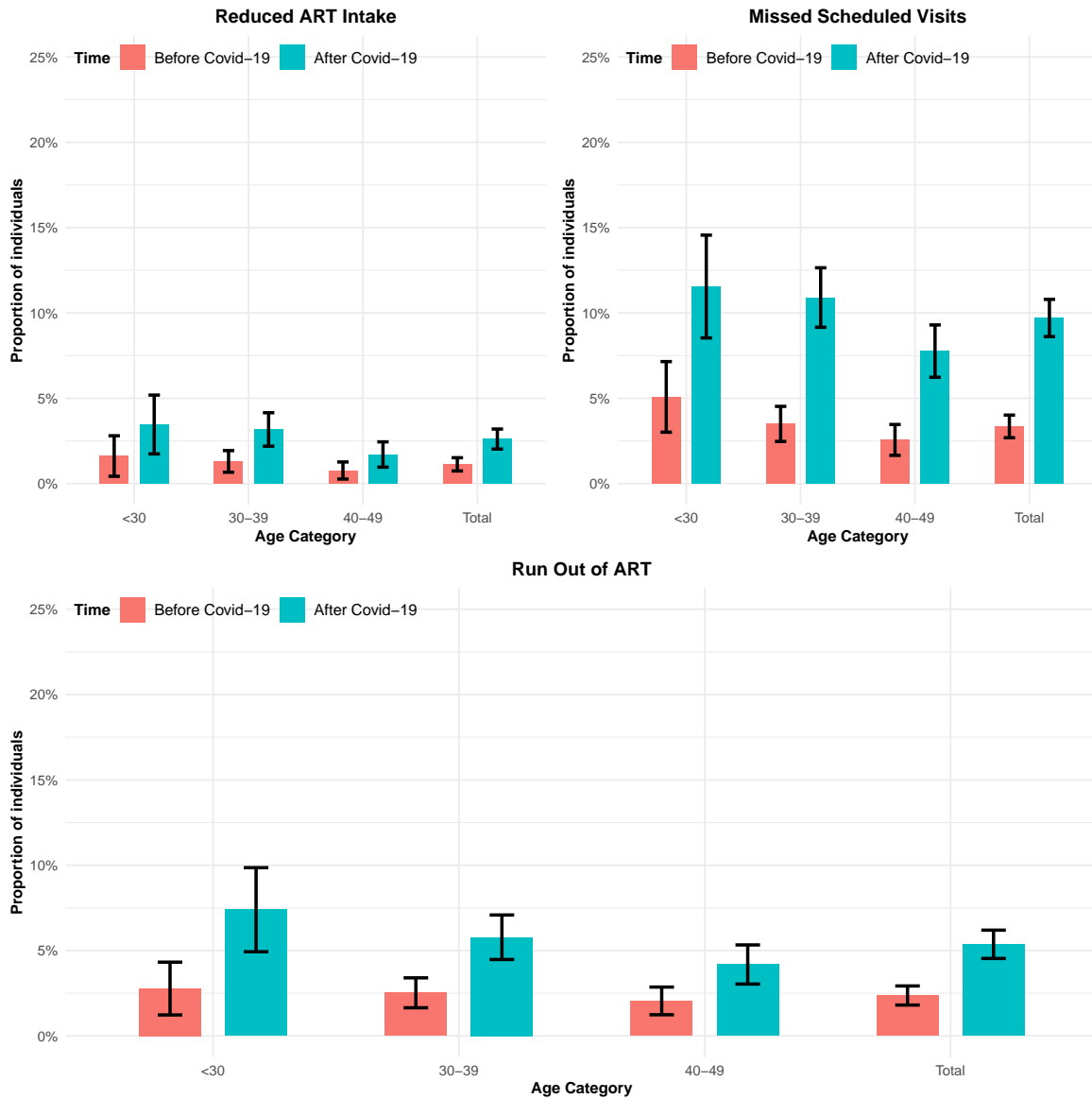


```
pa3 <- ggplot(df_age_artrun_summary, aes(x = age_cat, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
```

```
    title = "Run Out of ART",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pa3
```

Run Out of ART


```
### Combined plot
(pa1 + pa2)/pa3
```

Reduced ART Intake

Missed Scheduled Visits

Run Out of ART

ART Duration

```
df_dur <- rakai %>%
  select(artyrs,artrunbc,artrunac,
         hivac,hivbc,copies,new_copies,artstrac,artstrbc) %>%
  filter(hivac !=8, hivbc!=8,artrunbc!=8,artstrac!=8,artstrbc!=8,artrunac!=8) %>%
```

```
mutate(
 art_duration = case_when(
     artyrs >= 2 &  artyrs <= 5 ~ "2-5 years",
    artyrs > 5 ~ ">5 years",
    .default =  "<2 years"
 ) %>%
   fct_relevel("<2 years","2-5 years") %>%
   ff_label("Time on ART"),

   hivac = if_else(hivac ==1, "Yes","No") %>%
   ff_label("Missed scheduled visit for HIV care") %>%
    as_factor(),

   hivbc = if_else(hivbc ==1,"Yes","No") %>%
   ff_label("Missed scheduled visit for HIV care") %>%
   as_factor(),

   artrunac = if_else(artrunac ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Run out of ART before next refill"),

  artrunbc = if_else(artrunbc ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Run out of ART before next refill"),

  artstrac = if_else(artstrac ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply"),

  artstrbc = if_else(artstrbc ==1,"Yes","No") %>%
   as_factor() %>%
   ff_label("Taken ART pills less frequently / in smaller
amounts to conserve supply")
 ) %>%
 select(-artyrs)
```

```
# df_dur
```

```
df_dur %>% group_by(art_duration,artstrbc) %>%
  count()
```

art_duration	artstrbc	n
<2 years	No	166
<2 years	Yes	1
2-5 years	No	868
2-5 years	Yes	12
>5 years	No	1768
>5 years	Yes	19

```
df_dur %>% group_by(art_duration,artstrac) %>%
  count()
```

art_duration	artstrac	n
<2 years	No	163
<2 years	Yes	4
2-5 years	No	852
2-5 years	Yes	28
>5 years	No	1745
>5 years	Yes	42

Reduced ART intake by ART duration

```
df_dur_artstr <- df_dur %>%
  pivot_longer(
    cols = c(artstrbc, artstrac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_dur_artstr_summary <- df_dur_artstr %>%
  group_by(time, art_duration) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )
```

```
df_dur_artstr_totals <- df_dur_artstr %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_dur_artstr_summary <- bind_rows(df_dur_artstr_summary, df_dur_artstr_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),

    art_duration = if_else(is.na(art_duration), "Total", art_duration) %>%
      fct_relevel("<2 years","2-5 years"),
    lower = if_else(lower < 0,0,lower)
  )

df_dur_artstr_summary
```
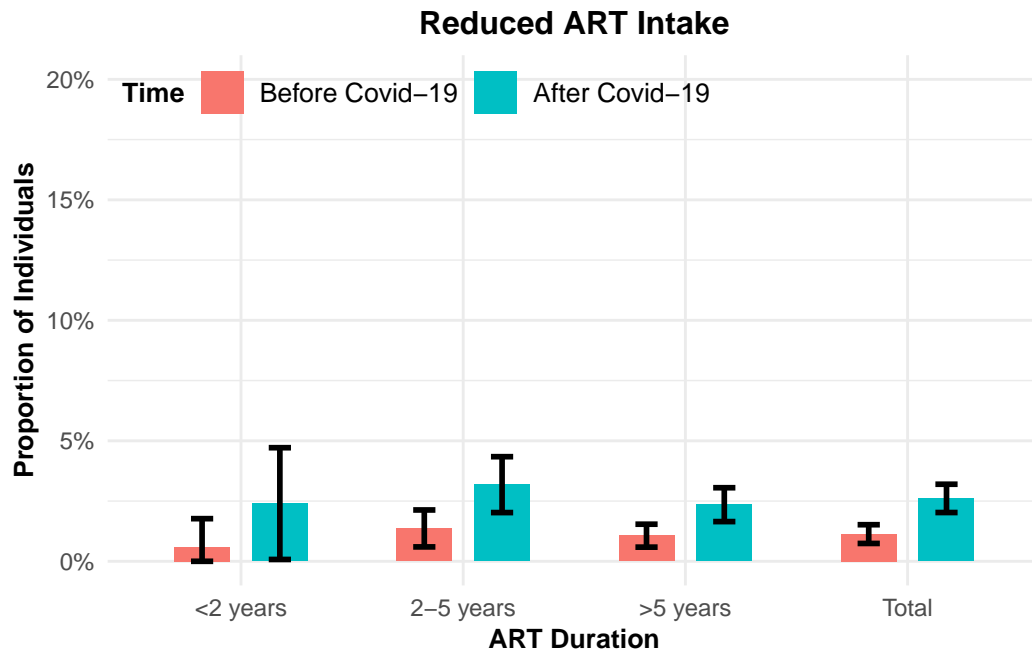
time	art_duration	n_yes	n	proportion	se	lower	upper
After Covid-19	<2 years	4	167	0.0239521	0.0118318	0.0007619	0.0471423
After Covid-19	2-5 years	28	880	0.0318182	0.0059166	0.0202216	0.0434148
After Covid-19	>5 years	42	1787	0.0235031	0.0035837	0.0164790	0.0305272
Before Covid-19	<2 years	1	167	0.0059880	0.0059701	0.0000000	0.0176894
Before Covid-19	2-5 years	12	880	0.0136364	0.0039095	0.0059737	0.0212991
Before Covid-19	>5 years	19	1787	0.0106323	0.0024262	0.0058769	0.0153877
After Covid-19	Total	74	2834	0.0261115	0.0029955	0.0202403	0.0319827
Before Covid-19	Total	32	2834	0.0112915	0.0019848	0.0074013	0.0151816

```r
reduced_art_intake_by_duration_plot <- ggplot(df_dur_artstr_summary, aes(x = art_duration, y
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.20)) +
  labs(
    title = "Reduced ART Intake",
    x = "ART Duration",
    y = "Proportion of Individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

reduced_art_intake_by_duration_plot
```

Run out of ART by ART Duration

```
df_dur %>% group_by(art_duration,artrunbc) %>%
  count()
```

art_duration	artrunbc	n
<2 years	No	165
<2 years	Yes	2
2-5 years	No	864
2-5 years	Yes	16
>5 years	No	1738
>5 years	Yes	49

```
df_dur %>% group_by(art_duration,artrunac) %>%
  count()
```

art_duration	artrunac	n
<2 years	No	157

art_duration	artrunac	n
<2 years	Yes	10
2-5 years	No	826
2-5 years	Yes	54
>5 years	No	1699
>5 years	Yes	88

```r
df_dur_artrun <- df_dur %>%
  mutate(
    artrunbc = as.character(artrunbc),
    artrunac = as.character(artrunac)
  ) %>%
  pivot_longer(
    cols = c(artrunbc, artrunac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_dur_artrun_summary <- df_dur_artrun %>%
  group_by(time, art_duration) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_dur_artrun_totals <- df_dur_artrun %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_dur_artrun_summary <- bind_rows(df_dur_artrun_summary, df_dur_artrun_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
```

```
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    art_duration = if_else(is.na(art_duration), "Total", art_duration)%>%
      fct_relevel("<2 years","2-5 years"),
    lower = if_else(lower < 0,0,lower)
  )


df_dur_artrun_summary
```

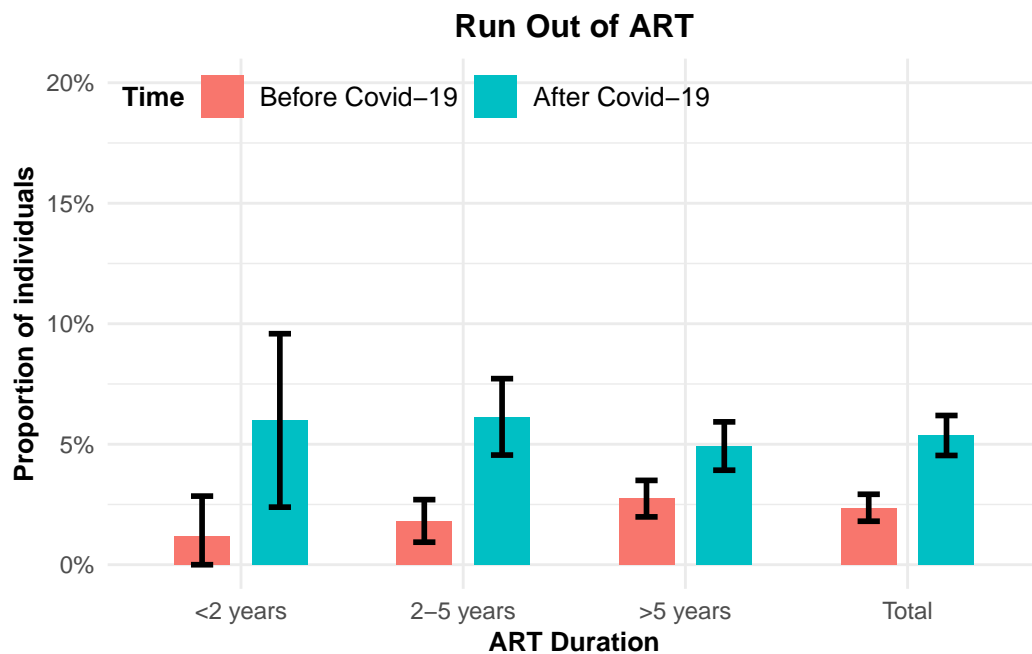| time	art_duration	n_yes	n	proportion	se	lower	upper
After Covid-19	<2 years	10	167	0.0598802	0.0183601	0.0238944	0.0958660
After Covid-19	2-5 years	54	880	0.0613636	0.0080903	0.0455067	0.0772206
After Covid-19	>5 years	88	1787	0.0492445	0.0051186	0.0392121	0.0592770
Before Covid-19	<2 years	2	167	0.0119760	0.0084175	0.0000000	0.0284743
Before Covid-19	2-5 years	16	880	0.0181818	0.0045039	0.0093541	0.0270095
Before Covid-19	>5 years	49	1787	0.0274203	0.0038631	0.0198486	0.0349919
After Covid-19	Total	152	2834	0.0536344	0.0042321	0.0453396	0.0619293
Before Covid-19	Total	67	2834	0.0236415	0.0028539	0.0180478	0.0292352

```
run_out_of_art_by_duration_plot <- ggplot(df_dur_artrun_summary, aes(x = art_duration, y = p
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.20)) +
  labs(
    title = "Run Out of ART",
    x = "ART Duration",
    y = "Proportion of individuals",
```

```
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

run_out_of_art_by_duration_plot
```


Missed Scheduled visit by ART Duration

```
df_dur %>% group_by(art_duration,hivbc) %>%
  count()
```

art_duration	hivbc	n
<2 years	No	164
<2 years	Yes	3
2-5 years	No	849
2-5 years	Yes	31
>5 years	No	1726
>5 years	Yes	61

```
df_dur %>% group_by(art_duration,hivac) %>%
  count()
```

art_duration	hivac	n
<2 years	No	149
<2 years	Yes	18
2-5 years	No	788
2-5 years	Yes	92
>5 years	No	1622
>5 years	Yes	165

```
df_dur_hiv <- df_dur %>%
  mutate(
    hivbc = as.character(hivbc),
    hivac = as.character(hivac)
  ) %>%
  pivot_longer(
    cols = c(hivbc, hivac),
    names_to = "variable",
    values_to = "response"
  ) %>%
  mutate(
    time = if_else(grepl("bc$", variable), "Before Covid-19", "After Covid-19")
  )

df_dur_hiv_summary <- df_dur_hiv %>%
  group_by(time, art_duration) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
```

```
  )

df_dur_hiv_totals <- df_dur_hiv %>%
  group_by(time) %>%
  summarise(
    n_yes = sum(response == "Yes", na.rm = TRUE),
    n = n(),
    .groups = "drop"
  )

df_dur_hiv_summary <- bind_rows(df_dur_hiv_summary, df_dur_hiv_totals) %>%
  mutate(
    proportion = n_yes / n,
    se = sqrt(proportion * (1 - proportion) / n),
    lower = proportion - 1.96 * se,
    upper = proportion + 1.96 * se
  ) %>%
  mutate(
    time = as_factor(time) %>%
      fct_relevel("Before Covid-19"),
    art_duration = if_else(is.na(art_duration), "Total", art_duration)%>%
      fct_relevel("<2 years","2-5 years"),
    lower = if_else(lower < 0,0,lower)
  )

df_dur_hiv_summary
```

time	art_duration	n_yes	n	proportion	se	lower	upper
After Covid-19	<2 years	18	167	0.1077844	0.0239969	0.0607506	0.1548183
After Covid-19	2-5 years	92	880	0.1045455	0.0103141	0.0843297	0.1247612
After Covid-19	>5 years	165	1787	0.0923335	0.0068483	0.0789109	0.1057561
Before Covid-19	<2 years	3	167	0.0179641	0.0102780	0.0000000	0.0381089
Before Covid-19	2-5 years	31	880	0.0352273	0.0062146	0.0230467	0.0474078
Before Covid-19	>5 years	61	1787	0.0341354	0.0042953	0.0257165	0.0425543
After Covid-19	Total	275	2834	0.0970360	0.0055603	0.0861377	0.1079343
Before Covid-19	Total	95	2834	0.0335215	0.0033811	0.0268946	0.0401485

```
missed_scheduled_visit_by_duration_plot <- ggplot(df_dur_hiv_summary, aes(x = art_duration,
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.20)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "ART Duration",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

missed_scheduled_visit_by_duration_plot
```

Missed Scheduled Visits

```
pd1 <- ggplot(df_dur_artstr_summary, aes(x = art_duration, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Reduced ART Intake",
    x = "ART Duration",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 14),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
```
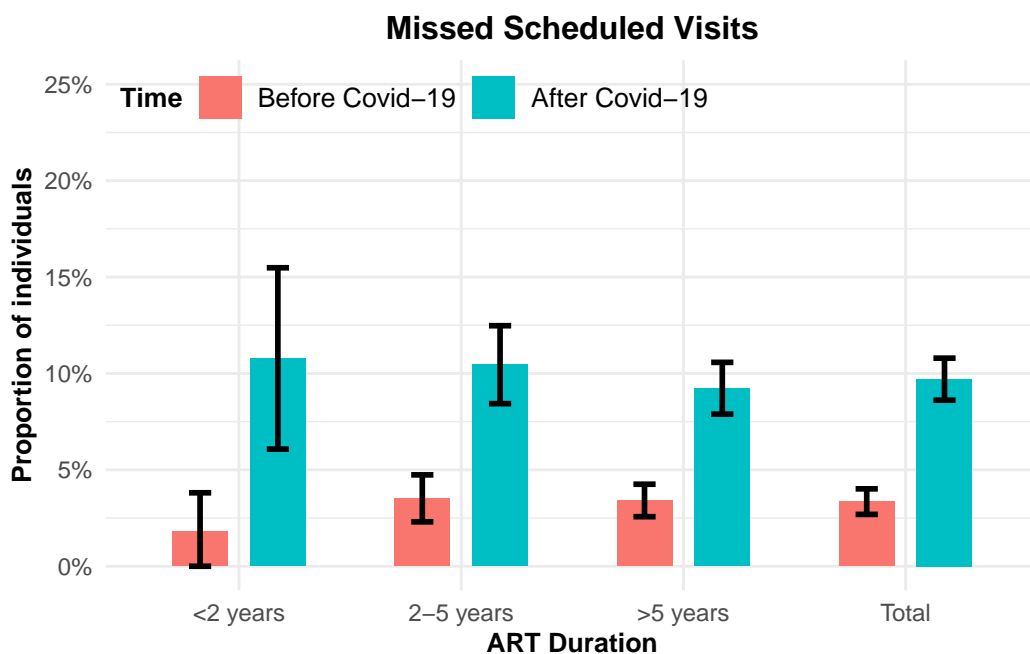
```
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pd1
```

Reduced ART Intake


```
pd2 <- ggplot(df_dur_hiv_summary, aes(x = art_duration, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Missed Scheduled Visits",
    x = "ART Duration",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
```
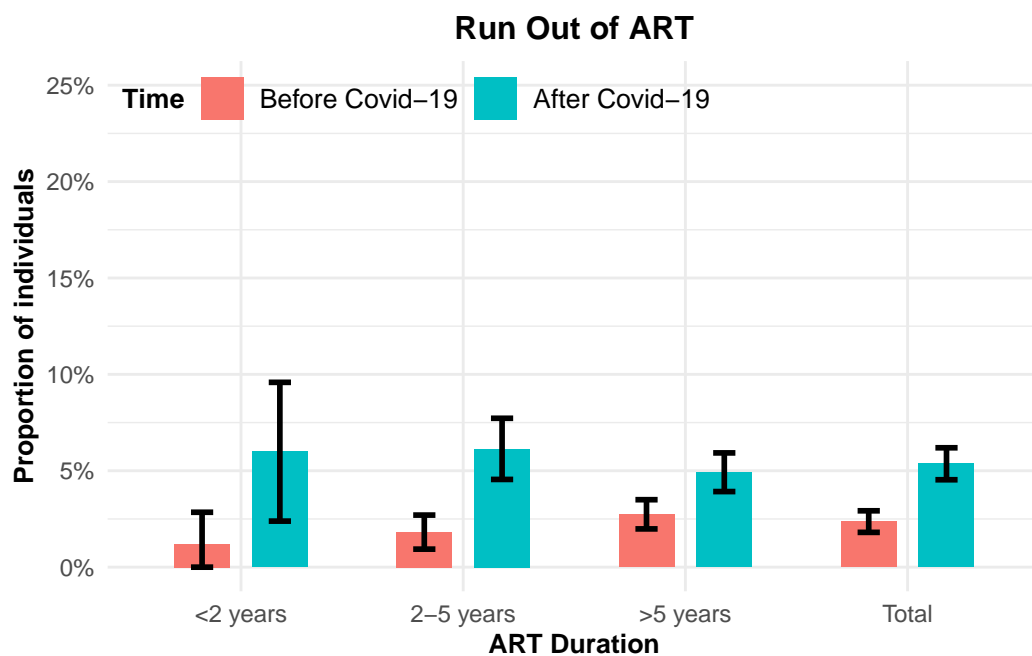
```
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pd2
```

Missed Scheduled Visits


```
pd3 <- ggplot(df_dur_artrun_summary, aes(x = art_duration, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
```

```
    labs(
      title = "Run Out of ART",
      x = "ART Duration",
      y = "Proportion of individuals",
      fill = "Time"
    ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pd3
```



```
### Combined plot
(pd1 + pd2)/pd3
```

Reduced ART Intake

Missed Scheduled Visits

Run Out of ART
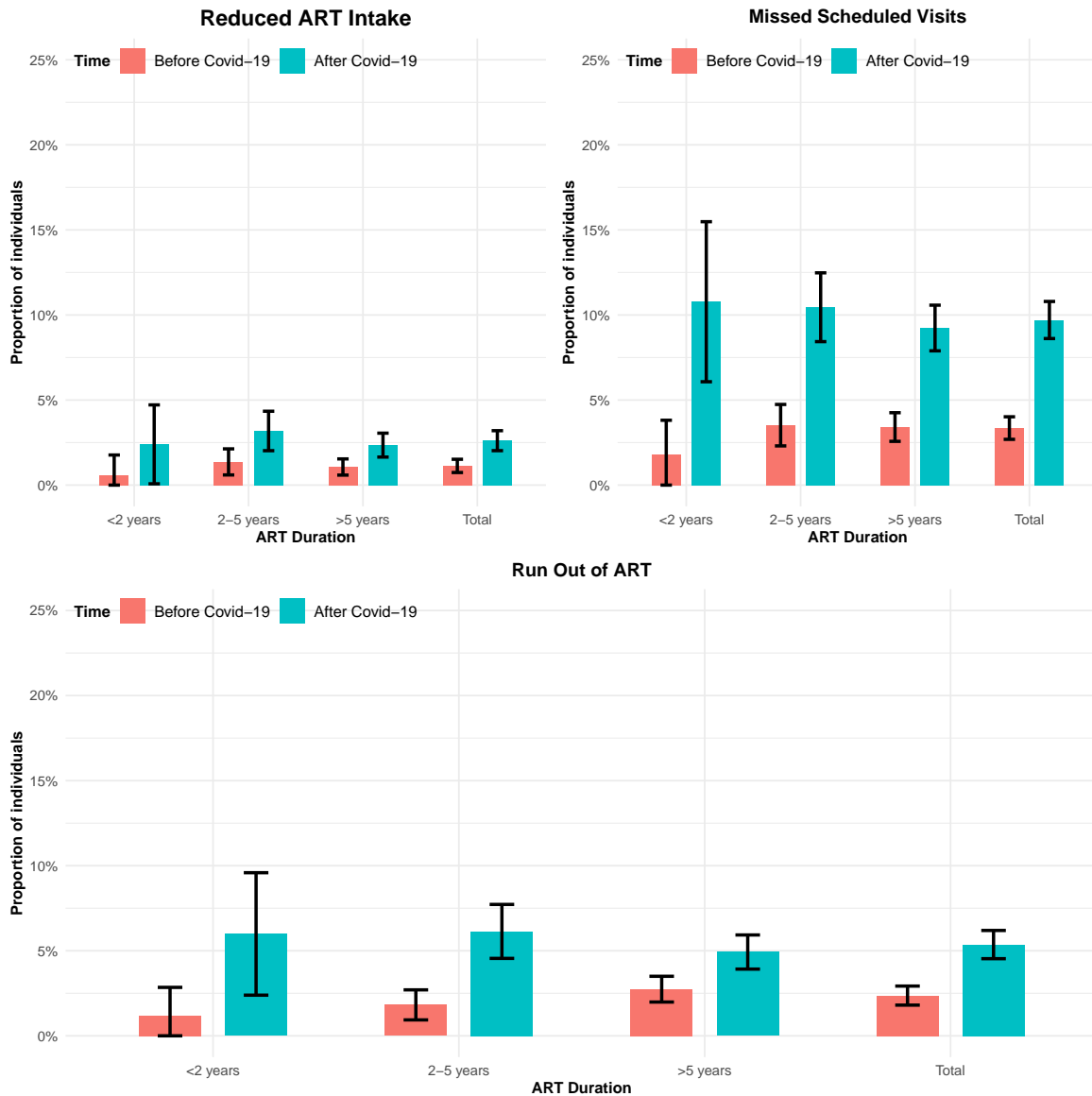
Any disruption subplots

```
df_disruption <-  rakai %>%
  select(ageyrs,sex,mobility,arthoac,artrunac,artstrac,
    artyrs,comm_num,artrunbc,artstrbc,hivac,hivbc,copies,new_copies) %>%
  mutate(
```

```r
age_cat = case_when(
  ageyrs < 30 ~ "<30",
  ageyrs >= 30 & ageyrs <= 39 ~  "30-39",
  ageyrs >=40 & ageyrs <= 49 ~ "40-49") %>%
  fct_relevel("<30") %>%
  ff_label("Age group"),

sex = if_else(sex == "F","Female","Male") %>%
  as_factor() %>%
  fct_relevel("Female") %>%
  ff_label("Sex"),

mobility = case_when(
  mobility %in% c(3,8,10) ~ "In-migrant",
  .default = "Long-term resident") %>%
  fct_relevel("In-migrant") %>%
  ff_label("Migration"),

community_type = case_when(
  comm_num %in% c(38,770,771,774) ~ "Fishing community",
  .default = "Inland Community") %>%
  fct_relevel("Inland Community") %>%
  ff_label("Community type"),
fishing_comm = if_else(community_type == "Fishing Community",1,0) %>%
  ff_label("Lake Victoria Fishing Community"),

art_duration = case_when(
  artyrs >= 2 &  artyrs <= 5 ~ "2-5 years",
  artyrs > 5 ~ ">5 years",
  .default =  "<2 years"
) %>%
  fct_relevel("<2 years","2-5 years") %>%
  ff_label("Time on ART"),

hivac = if_else(hivac == 1, 1, 0) %>%
  ff_label("Missed scheduled visit for HIV care"),

hivbc = if_else(hivbc == 1, 1, 0) %>%
  ff_label("Missed scheduled visit for HIV care"),

artrunac = if_else(artrunac == 1, 1, 0) %>%
  ff_label("Run out of ART before next refill"),
```

```
      artrunbc = if_else(artrunbc == 1, 1, 0) %>%
        ff_label("Run out of ART before next refill"),

      artstrac = if_else(artstrac == 1, 1, 0) %>%
        ff_label("Taken ART pills less frequently / in smaller amounts to conserve supply"),

      artstrbc = if_else(artstrbc == 1, 1, 0) %>%
        ff_label("Taken ART pills less frequently / in smaller amounts to conserve supply"),

    )
```

```
df_disruption <-  df_disruption %>%
  select(sex,age_cat,community_type,art_duration,mobility,hivac,artrunac,artstrac,hivbc,arts
```

```
df_disruption <-  df_disruption %>%
mutate(any_disruption_b4 = if_else(rowSums(across(hivbc:artrunbc),na.rm = TRUE) > 0,1,0),
any_disruption_after = if_else(rowSums(across(hivac:artstrac),na.rm = TRUE) > 0,1,0))
```

```
table(df_disruption$any_disruption_b4)
```

```
   0    1
2699  140
```

```
table(df_disruption$any_disruption_after)
```

```
   0    1
2457  382
```

```
prepare_data <- function(data, group_var) {
  grouped_data <- data %>%
    group_by({{ group_var }}) %>%
    summarise(
      n_b4 = sum(any_disruption_b4, na.rm = TRUE),
      total_b4 = n(),
      n_after = sum(any_disruption_after, na.rm = TRUE),
      total_after = n(),
      .groups = "drop"
```

```r
) %>%
mutate(
  proportion_b4 = n_b4 / total_b4,
  proportion_after = n_after / total_after,
  se_b4 = sqrt(proportion_b4 * (1 - proportion_b4) / total_b4),
  se_after = sqrt(proportion_after * (1 - proportion_after) / total_after),
  lower_b4 = proportion_b4 - 1.96 * se_b4,
  upper_b4 = proportion_b4 + 1.96 * se_b4,
  lower_after = proportion_after - 1.96 * se_after,
  upper_after = proportion_after + 1.96 * se_after
) %>%
pivot_longer(
  cols = starts_with("proportion"),
  names_to = "time",
  values_to = "proportion"
) %>%
mutate(
  time = if_else(time == "proportion_b4", "Before Covid-19", "After Covid-19"),
  lower = if_else(time == "Before Covid-19", lower_b4, lower_after),
  upper = if_else(time == "Before Covid-19", upper_b4, upper_after)
) %>%
select({{ group_var }}, time, proportion, lower, upper)


total_data <- data %>%
summarise(
  n_b4 = sum(any_disruption_b4, na.rm = TRUE),
  total_b4 = n(),
  n_after = sum(any_disruption_after, na.rm = TRUE),
  total_after = n(),
  .groups = "drop"
) %>%
mutate(
  proportion_b4 = n_b4 / total_b4,
  proportion_after = n_after / total_after,
  se_b4 = sqrt(proportion_b4 * (1 - proportion_b4) / total_b4),
  se_after = sqrt(proportion_after * (1 - proportion_after) / total_after),
  lower_b4 = proportion_b4 - 1.96 * se_b4,
  upper_b4 = proportion_b4 + 1.96 * se_b4,
  lower_after = proportion_after - 1.96 * se_after,
  upper_after = proportion_after + 1.96 * se_after
) %>%
```

```r
  pivot_longer(
    cols = starts_with("proportion"),
    names_to = "time",
    values_to = "proportion"
  ) %>%
  mutate(
    time = if_else(time == "proportion_b4", "Before Covid-19", "After Covid-19"),
    lower = if_else(time == "Before Covid-19", lower_b4, lower_after),
    upper = if_else(time == "Before Covid-19", upper_b4, upper_after),
    {{ group_var }} := "Total" # Add "Total" to the group variable
  ) %>%
  select({{ group_var }}, time, proportion, lower, upper)

  bind_rows(grouped_data, total_data)
}
```

```r
summary_by_sex <- prepare_data(df_disruption, sex)
summary_by_age <- prepare_data(df_disruption, age_cat)
summary_by_mobility <- prepare_data(df_disruption, mobility)
summary_by_community <- prepare_data(df_disruption, community_type)
summary_by_art_duration <- prepare_data(df_disruption,art_duration)
```

```r
summary_by_age <-  summary_by_age %>%
  mutate(age_cat = as_factor(age_cat) %>%
           fct_relevel("<30","30-39","40-49"),
         time = as_factor(time) %>%
           fct_relevel("Before Covid-19"))
```

```r
summary_by_community <-  summary_by_community %>%
  mutate(
   time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
   community_type = as_factor(community_type) %>%
     fct_relevel("Fishing community")
  )
```

```r
summary_by_mobility <-  summary_by_mobility %>%
  mutate(
    time = as_factor(time) %>%
           fct_relevel("Before Covid-19"),
    mobility = as_factor(mobility) %>%
```

```
        fct_relevel("In-migrant","Long-term resident")
  )


summary_by_sex <-  summary_by_sex %>%
  mutate(
    time = as_factor(time) %>%
          fct_relevel("Before Covid-19"),
    sex = as_factor(sex) %>%
      fct_relevel("Female","Male")
  )


summary_by_art_duration <-  summary_by_art_duration %>%
  mutate(
    time = as_factor(time) %>%
          fct_relevel("Before Covid-19"),
    art_duration = as_factor(art_duration) %>%
      fct_relevel("<2 years","2-5 years", ">5 years","Total")
  )
```

Any Disruption by Sex

```
pr1 <- summary_by_sex %>%
ggplot(aes(x = sex, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.20)) +
  labs(
    title = "Any Disruption",
    x = "Sex",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
```
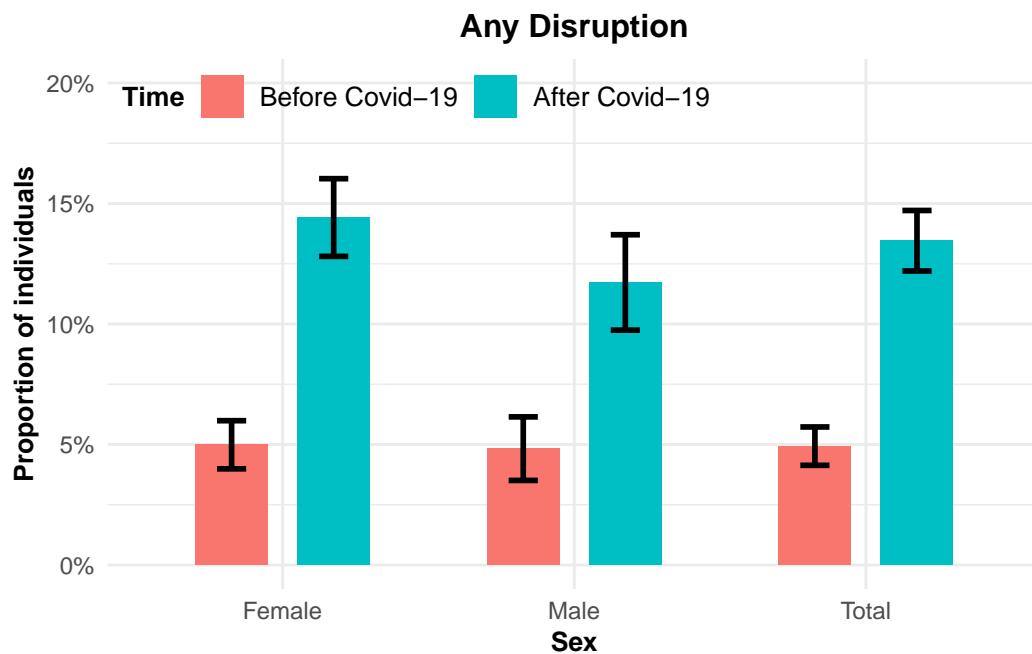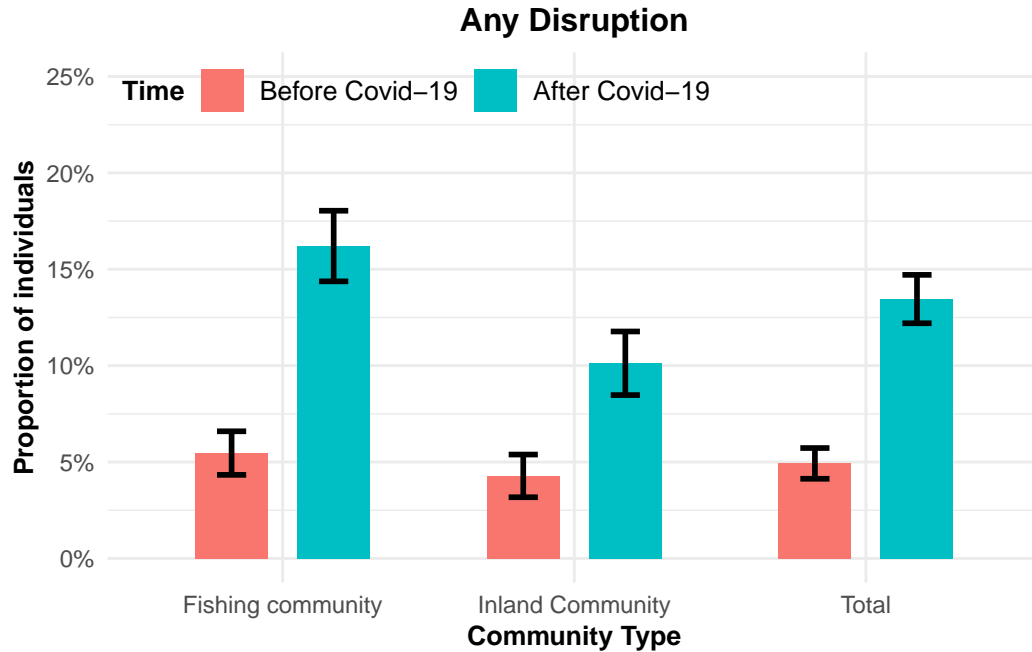
```
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pr1
```

Any Disruption

Any disruption by community type

```
pr2 <- summary_by_community %>%
ggplot(aes(x = community_type, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
```

```
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Any Disruption",
    x = "Community Type",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pr2
```
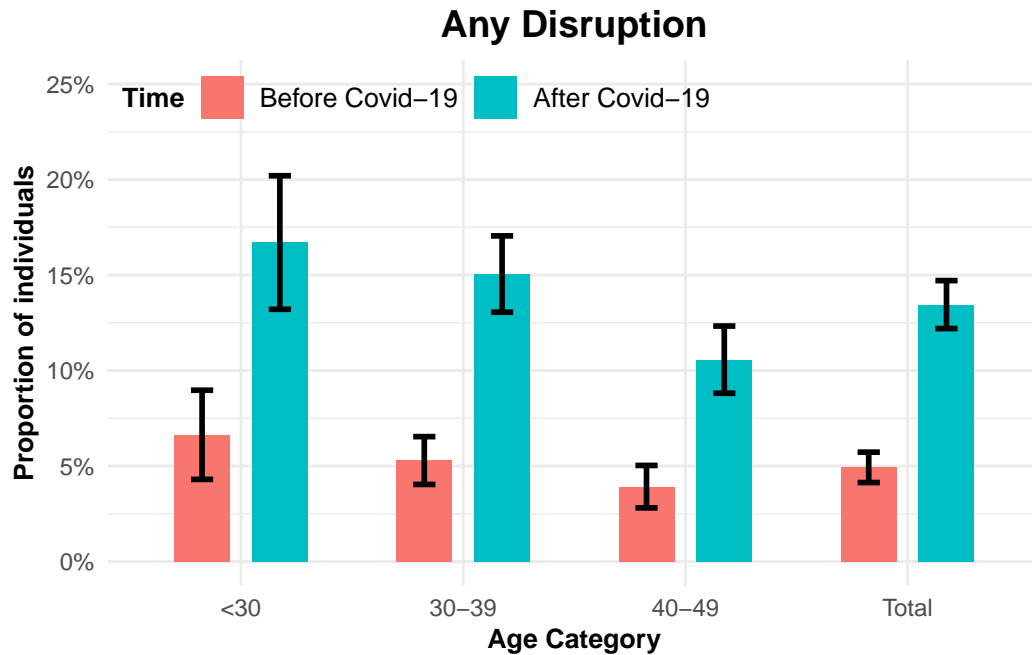
Any disruption by age category

```r
pr3 <- summary_by_age %>%
ggplot(aes(x = age_cat, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Any Disruption",
    x = "Age Category",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 14),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pr3
```

Any Disruption

Any Disruption By Mobility

```r
pr4 <- summary_by_mobility %>%
ggplot(aes(x = mobility, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.26)) +
  labs(
    title = "Any Disruption",
    x = "Mobility",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
```
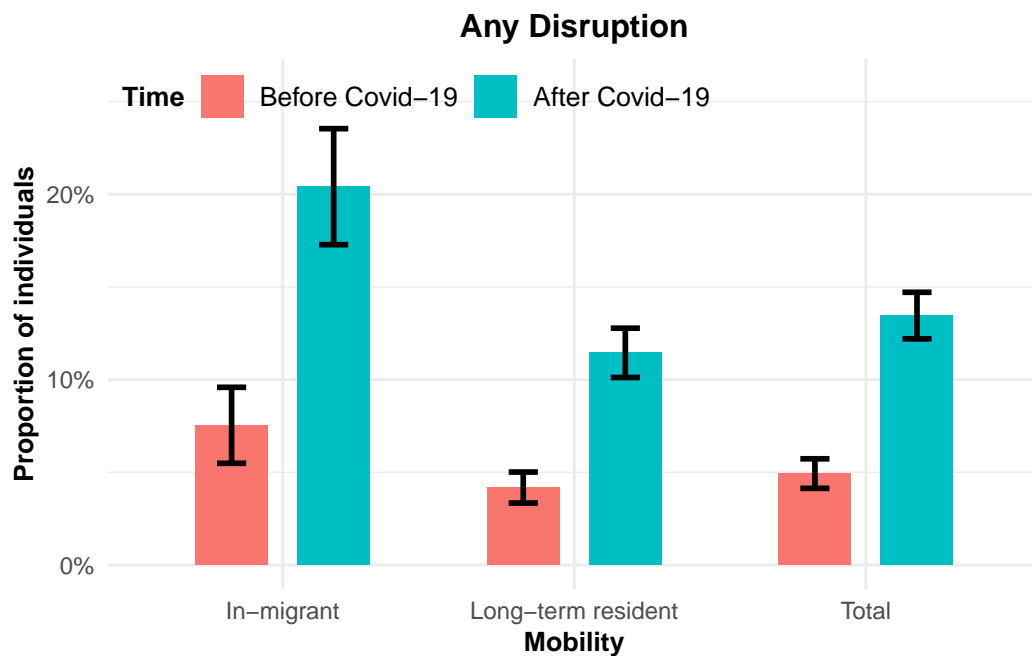
```
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pr4
```

Any Disruption

Any Disruption by ART duration

```
pr5 <- summary_by_art_duration %>%
ggplot(aes(x = art_duration, y = proportion, fill = time)) +
  geom_col(position = position_dodge(width = 0.7), width = 0.5) +
  geom_errorbar(
    aes(ymin = lower, ymax = upper),
    position = position_dodge(width = 0.7),
    width = 0.2,
```

```
    size = 1
  ) +
  scale_y_continuous(labels = scales::percent_format(accuracy = 1), limits = c(0, 0.25)) +
  labs(
    title = "Any Disruption",
    x = "ART Duration",
    y = "Proportion of individuals",
    fill = "Time"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5, face = "bold", size = 12),
    axis.title.x = element_text(face = "bold", size = 10),
    axis.title.y = element_text(face = "bold", size = 10),
    legend.title = element_text(face = "bold", size = 10),
    legend.text = element_text(size = 10),
    legend.position = c(0, 1),
    legend.justification = c(0, 1),
    legend.direction = "horizontal"
  )

pr5
```
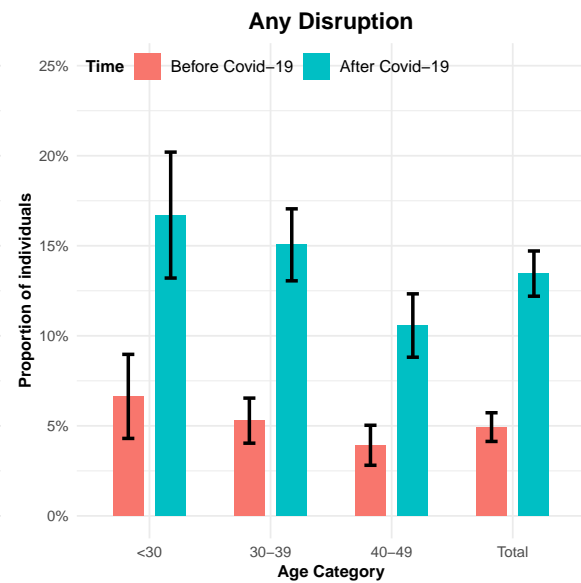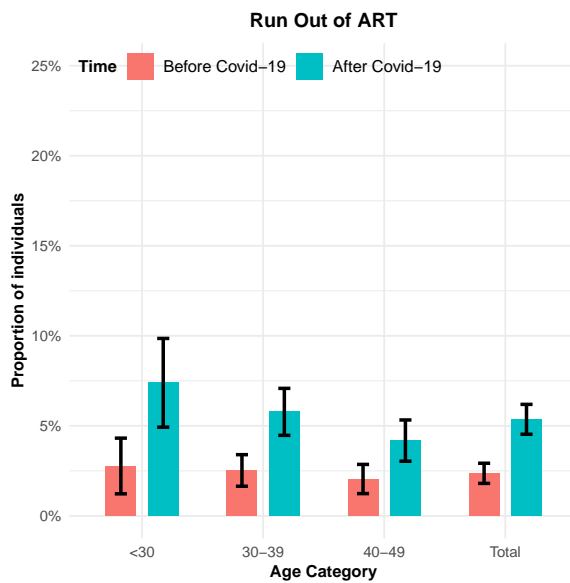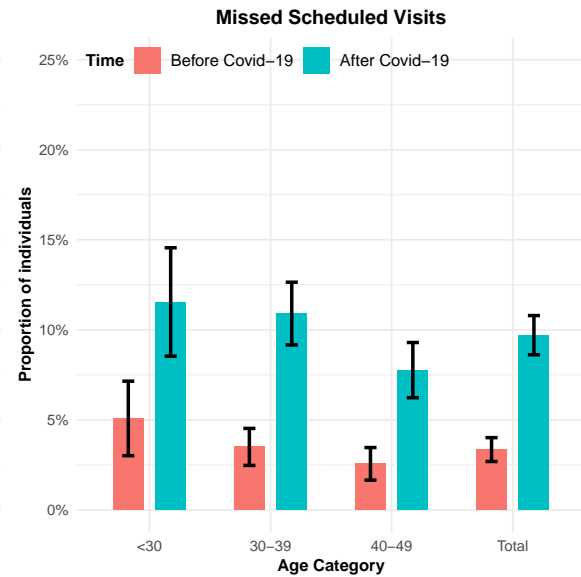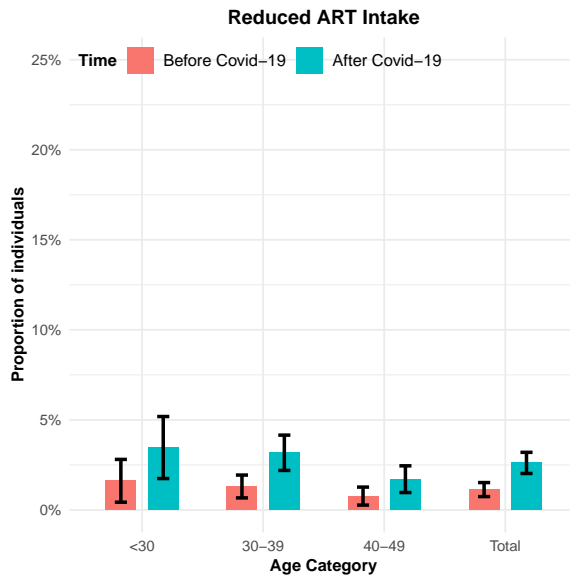

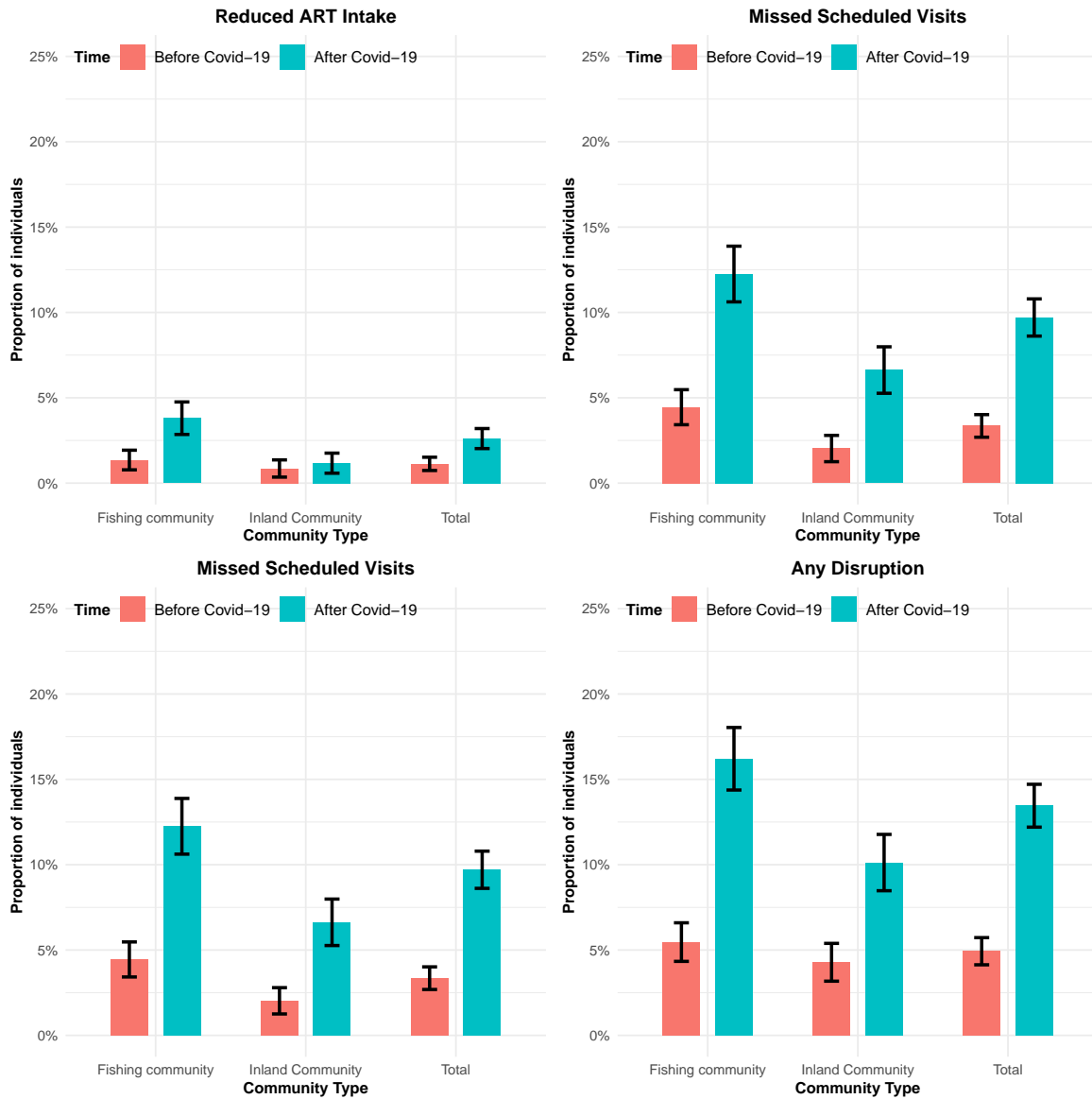
Any Disruption
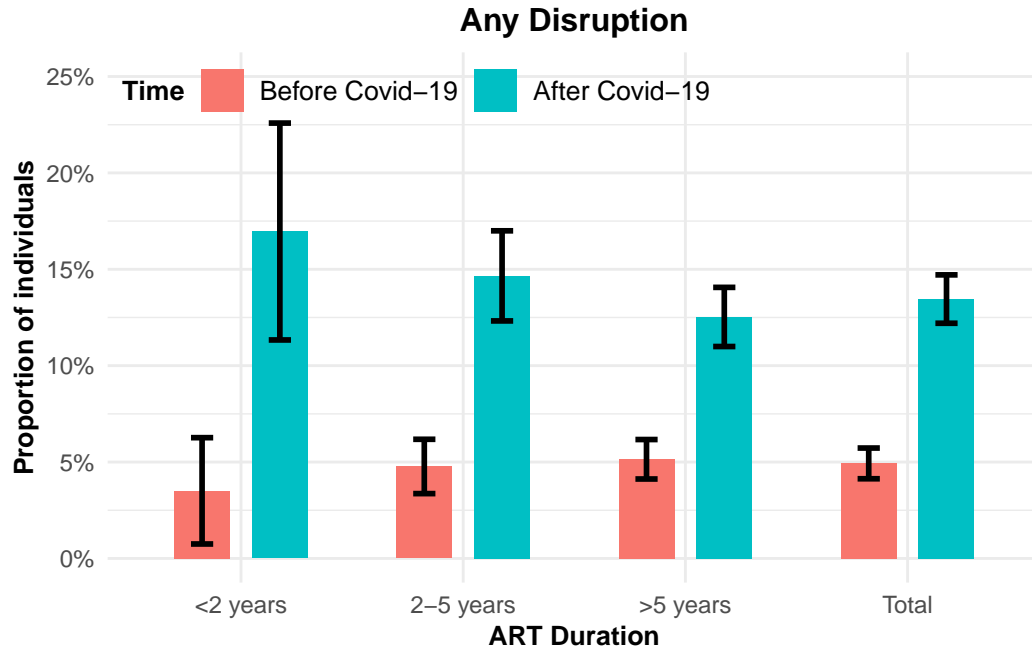
Combined Plots

Age category

```
### Combined plot
(pa1 + pa2)/(pa3 + pr3)
```
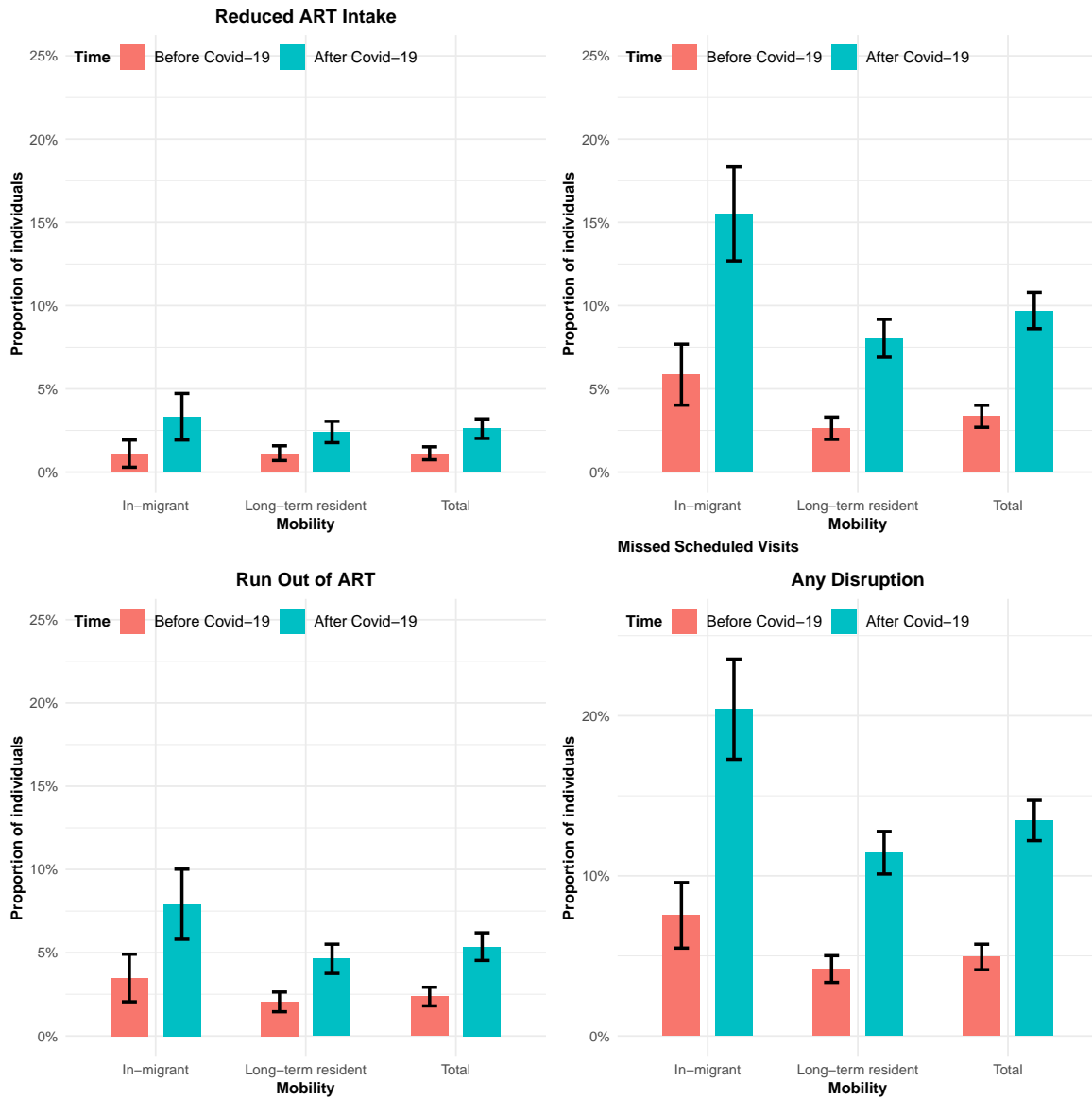
Community type

```
### Combined plot
(pc1 + pc2)/(pc2 + pr2)
```
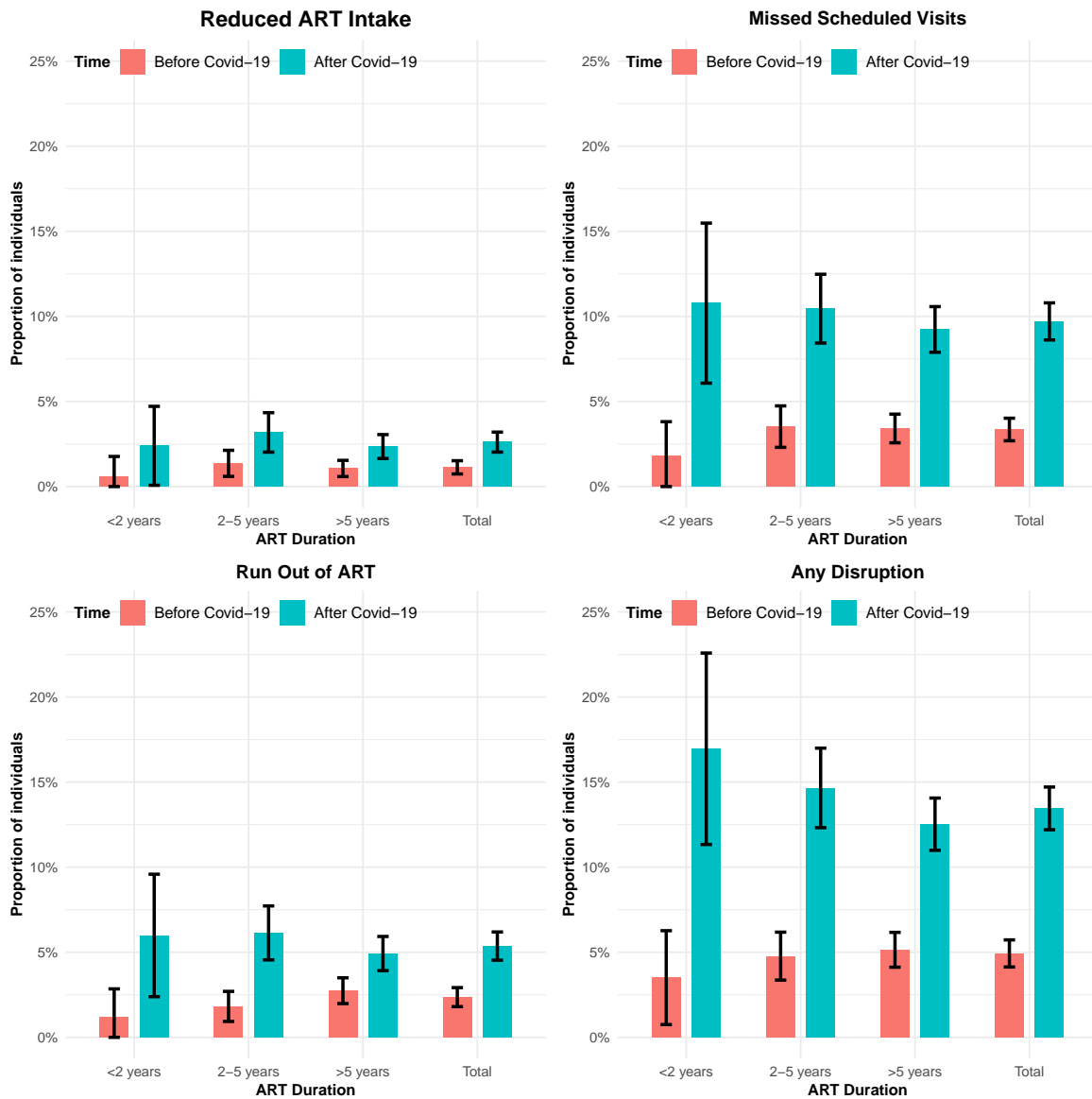
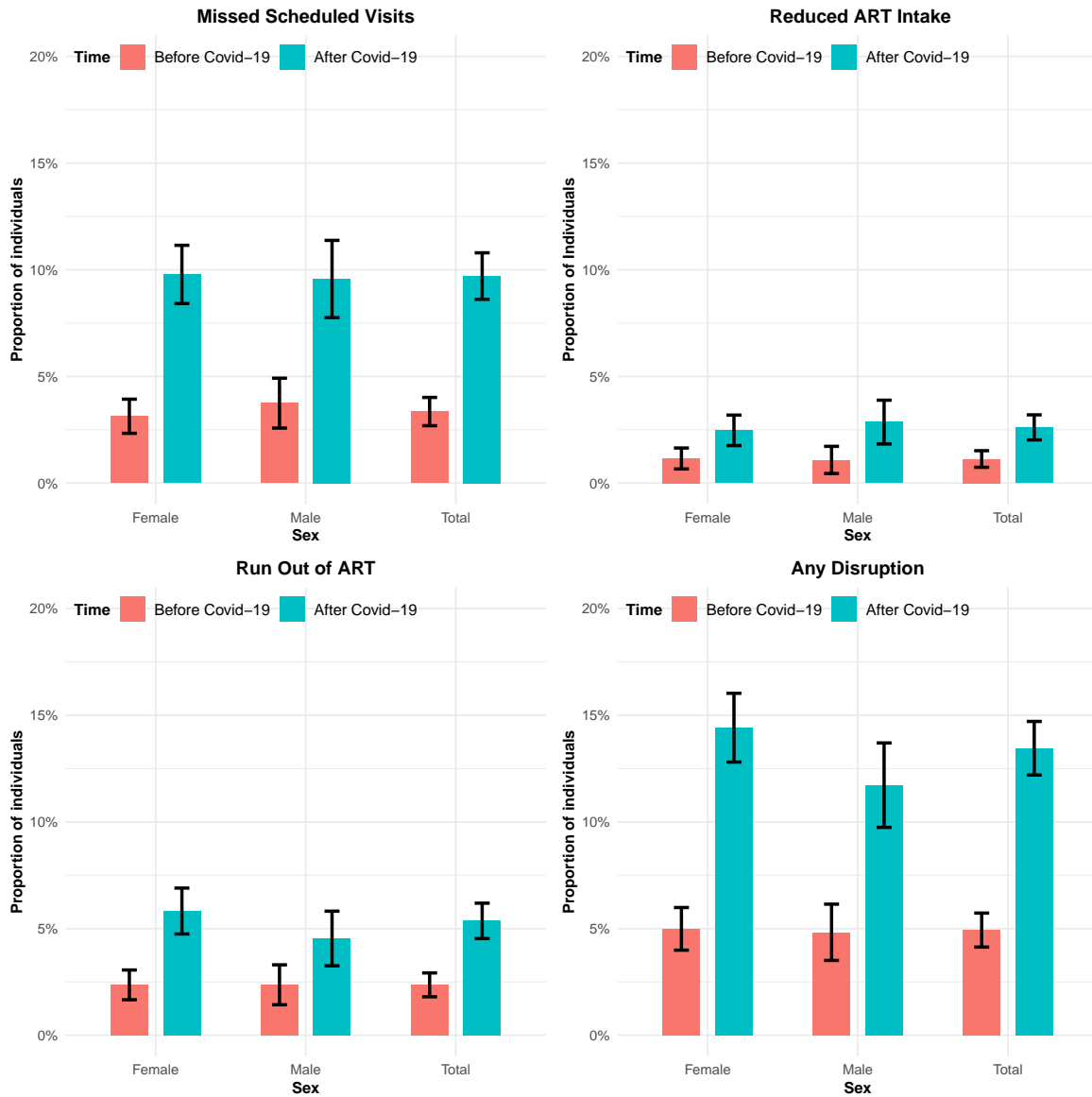## Mobility

```
### Combined plot
(pm1 + pm2)/(pm3 +pr4)
```

ART Duration

```
### Combined plot
(pd1 + pd2)/(pd3 + pr5)
```

Sex

```
### Combined plot
(ps1 + ps2)/(ps3 + pr1)
```

VIRAEMIA PREVALENCE

```r
df_rakai_reg <- rakai %>%
  select(ageyrs,sex,mobility,arthoac,artrunac,artstrac,
         artyrs,comm_num,artrunbc,artstrbc,hivac,hivbc,copies,new_copies) %>%
  filter(copies != "INV.IC ",!is.na(copies),!is.na(new_copies)) %>%

  mutate(
    copies = str_remove_all(copies, "<\\s*"),
    copies = if_else(copies == "BD", "0", copies),
    copies = as.numeric(copies),

    new_copies = str_remove_all(new_copies, "<\\s*"),
    new_copies = if_else(new_copies == "BD", "0", new_copies),
    new_copies = as.numeric(new_copies)
  ) %>%
  mutate(viral_load_b4 = if_else(copies < 200, "Viral Load Sppression","Viraemia") %>%
           ff_label("HIV RNA viral load, in copies/ml"),
         viral_load_after = if_else(new_copies < 200,"Viral Load Sppression","Viraemia") %>%
           ff_label("HIV RNA viral load, in copies/ml")) %>%
  mutate(
    suppbc = if_else(viral_load_b4 == "Viral Load Suppression", 1, 0),
    suppac = if_else(viral_load_after == "Viral Load Suppression", 1, 0)
  ) %>%
 mutate(

    age_cat = case_when(
      ageyrs < 30 ~ "<30",
      ageyrs >= 30 & ageyrs <= 39 ~  "30-39",
      ageyrs >=40 & ageyrs <= 49 ~ "40-49") %>%
      fct_relevel("<30") %>%
      ff_label("Age group"),

    sex = if_else(sex == "F","Female","Male") %>%
      as_factor() %>%
      fct_relevel("Female") %>%
      ff_label("Sex"),

    mobility = case_when(
      mobility %in% c(3,8,10) ~ "In-migrant",
      .default = "Long-term resident") %>%
      fct_relevel("In-migrant") %>%
```

```r
      ff_label("Migration"),

    community_type = case_when(
      comm_num %in% c(38,770,771,774) ~ "Fishing community",
      .default = "Inland Community") %>%
      fct_relevel("Inland Community") %>%
      ff_label("Community type"),
    fishing_comm = if_else(community_type == "Fishing Community",1,0) %>%
      ff_label("Lake Victoria Fishing Community"),

    art_duration = case_when(
      artyrs >= 2 &  artyrs <= 5 ~ "2-5 years",
      artyrs > 5 ~ ">5 years",
      .default =   "<2 years"
    ) %>%
      fct_relevel("<2 years","2-5 years") %>%
      ff_label("Time on ART"),

    hivac = if_else(hivac == 1, 1, 0) %>%
      ff_label("Missed scheduled Visit"),

    hivbc = if_else(hivbc == 1, 1, 0) %>%
      ff_label("Missed Scheduled Visit"),

    artrunac = if_else(artrunac == 1, 1, 0) %>%
      ff_label("Run out of ARTl"),

    artrunbc = if_else(artrunbc == 1, 1, 0) %>%
      ff_label("Run out of ART"),

    artstrac = if_else(artstrac == 1, 1, 0) %>%
      ff_label("Reduced ART Intake"),

    artstrbc = if_else(artstrbc == 1, 1, 0) %>%
      ff_label("Reduced ART Intake"),

  )


df_viraemia <-   df_rakai_reg %>%
    select(sex,age_cat,mobility,community_type,art_duration,
           hivbc,artrunbc,artstrbc,hivac,artrunac,artstrac,viral_load_b4,
           viral_load_after,suppbc,suppac) %>%
```

```r
  mutate(any_disruption_b4 = if_else(rowSums(across(hivbc:artrunbc),na.rm = TRUE) > 0,1,0) %
           ff_label("Any ART Disruption"),
  any_disruption_after = if_else(rowSums(across(hivac:artstrac),na.rm = TRUE) > 0,1,0)%>%
  ff_label("Any ART Disruption"))


df_viraemia <-  df_viraemia %>%
  mutate(
    viraemia_after_covid = if_else(viral_load_after == "Viraemia","Yes","No") %>%
      fct_relevel("No") %>%
      ff_label("Viraemia"),
    viraemia_after_dum = if_else(viral_load_after == "Viraemia",1,0) %>%
      ff_label("Viraemia"),

    viraemia_b4_covid = if_else(viral_load_b4 == "Viraemia","Yes","No") %>%
      fct_relevel("No") %>%
      ff_label("Viraemia"),
    viraemia_b4_dum = if_else(viral_load_b4 == "Viraemia",1,0) %>%
      ff_label("Viraemia"),
     art_disruption_b4 = if_else(any_disruption_b4 == 1,"Yes","No") %>%
      fct_relevel("No") %>%
      ff_label("Any ART Disruption pre-covid"),

    art_disruption_after = if_else(any_disruption_after == 1,"Yes","No") %>%
      fct_relevel("No") %>%
      ff_label("Any ART Disruption post-covid")
  )


prr_table_full <- df_viraemia %>%
  select(art_disruption_b4,sex,age_cat,mobility,community_type,
         art_duration,viraemia_after_covid,art_disruption_after) %>%

  tbl_summary(
  by = viraemia_after_covid,
  percent = "row",
  include = c(art_disruption_after,art_disruption_b4,sex,age_cat,mobility,community_type,
              art_duration,viraemia_after_covid)
) %>%
modify_spanning_header(
  all_stat_cols() ~ "**Viraemia After COVID**" # Add a header for the `by` variable
)


prr_table_full
```

Characteristic	Viraemia After COVID	
	No N = 2,650[1]	**Yes** N = 135[1]
Any ART Disruption post-covid	347 (93%)	28 (7.5%)
Any ART Disruption pre-covid	115 (91%)	11 (8.7%)
Sex		
Female	1,714 (96%)	66 (3.7%)
Male	936 (93%)	69 (6.9%)
Age group		
<30	390 (90%)	44 (10%)
30-39	1,136 (94%)	67 (5.6%)
40-49	1,124 (98%)	24 (2.1%)
Migration		
In-migrant	596 (95%)	34 (5.4%)
Long-term resident	2,054 (95%)	101 (4.7%)
Community type		
Inland Community	1,212 (96%)	48 (3.8%)
Fishing community	1,438 (94%)	87 (5.7%)
Time on ART		
<2 years	160 (95%)	8 (4.8%)
2-5 years	810 (93%)	57 (6.6%)
>5 years	1,680 (96%)	70 (4.0%)

[1]n (%)

```
tbl_ureg <- df_viraemia %>%
  select(art_disruption_after,sex,age_cat,mobility,community_type,
        art_duration,viraemia_after_dum,art_disruption_b4) %>%
tbl_uvregression(
  method = glm.nb,
  y = viraemia_after_dum,
 # x = everything(),
  method.args = list(),
  exponentiate = TRUE
)

tbl_ureg <- tbl_ureg %>%
  modify_column_hide(columns = c("N", "p.value","N_obs"))

tbl_ureg
```

```
tbl_combined <- tbl_merge(
  tbls = list(prr_table_full, tbl_ureg), # Tables to combine
  tab_spanner = c("**Viraemia After COVID**", "**Prevalence Risk Ratios**") # Headers for ea
)
# Display the combined table
tbl_combined
```

Characteristic	Viraemia Post Covid-19 (n, %)		PRR	95% CI
	No (N = 2,650)	Yes (N = 135)		
Any ART Disruption post-covid	347 (93%)	28 (7.5%)	1.68	(1.09, 2.51)
Any ART Disruption pre-covid	115 (91%)	11 (8.7%)	1.87	(0.95, 3.31)
Sex				
Female	1,714 (96%)	66 (3.7%)	___	___
Male	936 (93%)	69 (6.9%)	1.85	(1.32, 2.60)
Age group				
<30	390 (90%)	44 (10%)	___	___
30-39	1,136 (94%)	67 (5.6%)	0.55	(0.38, 0.81)

40-49	1,124 (98%)	24 (2.1%)	0.21	(0.12, 0.34)
Migration				
In-migrant	596 (95%)	34 (5.4%)	___	___
Long-term resident	2,054 (95%)	101 (4.7%)	0.87	(0.60, 1.30)
Community type				
Inland Community	1,212 (96%)	48 (3.8%)	___	___
Fishing community	87 (5.7%)	1438 (94.3%)	1.50	(1.06, 2.15)

MULTIVARIABLE REGRESSION

```
model_nb1 <-df_viraemia %>%
  glm.nb(viraemia_after_dum ~ any_disruption_after + any_disruption_b4 + sex +
          age_cat+ mobility+community_type + art_duration, data = .)

model_nb1 %>% tidy(exponentiate = TRUE,conf.int = TRUE)
```

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	0.0491133	0.3960171	-7.6098368	0.0000000	0.0209455	0.1006322
any_disruption_after	1.4772637	0.2336166	1.6702215	0.0948756	0.9170111	2.2973503
any_disruption_b4	1.3979012	0.3431297	0.9762256	0.3289527	0.6785373	2.6356719
sexMale	2.2657061	0.1809734	4.5193734	0.0000062	1.5887687	3.2340908
age_cat30-39	0.4736388	0.2029918	-3.6814811	0.0002319	0.3192814	0.7090184
age_cat40-49	0.1736700	0.2695405	-6.4947518	0.0000000	0.1010904	0.2921329
mobilityLong-term resident	1.0877313	0.2091751	0.4020273	0.6876639	0.7297095	1.6605676
community_typeFishing community	1.1570889	0.1856366	0.7859836	0.4318771	0.8079466	1.6756067
art_duration2-5 years	1.4508306	0.3837690	0.9696881	0.3322020	0.7243206	3.3263437
art_duration>5 years	1.2176168	0.3824050	0.5148873	0.6066318	0.6103776	2.7867867

Characteristic	N	IRR[1]	95% CI[1]
Any ART Disruption post-covid	2,785		
No		—	—
Yes		1.68	1.09, 2.51
Sex	2,785		
Female		—	—
Male		1.85	1.32, 2.60
Age group	2,785		
<30		—	—
30-39		0.55	0.38, 0.81
40-49		0.21	0.12, 0.34
Migration	2,785		
In-migrant		—	—
Long-term resident		0.87	0.60, 1.30
Community type	2,785		
Inland Community		—	—
Fishing community		1.50	1.06, 2.15
Time on ART	2,785		
<2 years		—	—
2-5 years		1.38	0.70, 3.13
>5 years		0.84	0.43, 1.89
Any ART Disruption pre-covid	2,785		
No		—	—
Yes		1.87	0.95, 3.31

[1]IRR = Incidence Rate Ratio, CI = Confidence Interval

| Characteristic | Viraemia After COVID | | Prevalence Risk Ratios | | |
	No N = 2,650[1]	**Yes** N = 135[1]	**N**	**IRR**[2]	**95% CI**[2]
Any ART Disruption post-covid	347 (93%)	28 (7.5%)	2,785		
No				—	—
Yes				1.68	1.09, 2.51
Any ART Disruption pre-covid	115 (91%)	11 (8.7%)	2,785		
No				—	—
Yes				1.87	0.95, 3.31
Sex			2,785		
Female	1,714 (96%)	66 (3.7%)		—	—
Male	936 (93%)	69 (6.9%)		1.85	1.32, 2.60
Age group			2,785		
<30	390 (90%)	44 (10%)		—	—
30-39	1,136 (94%)	67 (5.6%)		0.55	0.38, 0.81
40-49	1,124 (98%)	24 (2.1%)		0.21	0.12, 0.34
Migration			2,785		
In-migrant	596 (95%)	34 (5.4%)		—	—
Long-term resident	2,054 (95%)	101 (4.7%)		0.87	0.60, 1.30
Community type			2,785		
Inland Community	1,212 (96%)	48 (3.8%)		—	—
Fishing community	1,438 (94%)	87 (5.7%)		1.50	1.06, 2.15
Time on ART			2,785		
<2 years	160 (95%)	8 (4.8%)		—	—
2-5 years	810 (93%)	57 (6.6%)		1.38	0.70, 3.13
>5 years	1,680 (96%)	70 (4.0%)		0.84	0.43, 1.89

[1]n (%)

[2]IRR = Incidence Rate Ratio, CI = Confidence Interval

```r
df_forest <- model_nb1 %>% tidy(exponentiate = TRUE,conf.int = TRUE)%>%
  filter(term != "(Intercept)") %>%
  mutate(term = case_when(
    term == "any_disruption_after" ~ "ART Disruption After (Yes)",
    term == "any_disruption_b4" ~ "ART Disruption Before (Yes)",
    term == "sexMale" ~ "Sex (Male vs Female)",
    term == "age_cat30-39" ~ "Age: 30-39 vs <30",
    term == "age_cat40-49" ~ "Age: 40-49 vs <30",
    term == "mobilityLong-term resident" ~ "Mobility (Long-term Resident)",
    term == "community_typeFishing community" ~ "Community Type (Fishing)",
    term == "art_duration2-5 years" ~ "ART Duration: 2-5 years",
    term == "art_duration>5 years" ~ "ART Duration: >5 years",
    TRUE ~ term
  )) %>%
  arrange(desc(estimate))


ggplot(df_forest, aes(y = reorder(term, estimate), x = estimate)) +
  geom_point(size = 3, color = "blue") +
  geom_errorbarh(aes(xmin = conf.low, xmax = conf.high), height = 0.2, color = "black") +
  geom_vline(xintercept = 1, linetype = "dashed", color = "red") +
  theme_minimal() +
  labs(
    title = "Forest Plot of Regression Results",
    x = "Prevalence Ratio (95% CI)",
    y = "Variables"
  ) +
  theme(
    axis.text.y = element_text(size = 12),
    axis.text.x = element_text(size = 10),
    plot.title = element_text(hjust = 0.5, face = "bold"),
    panel.grid.major.y = element_blank()
  )
```

Forest Plot of Regression Results
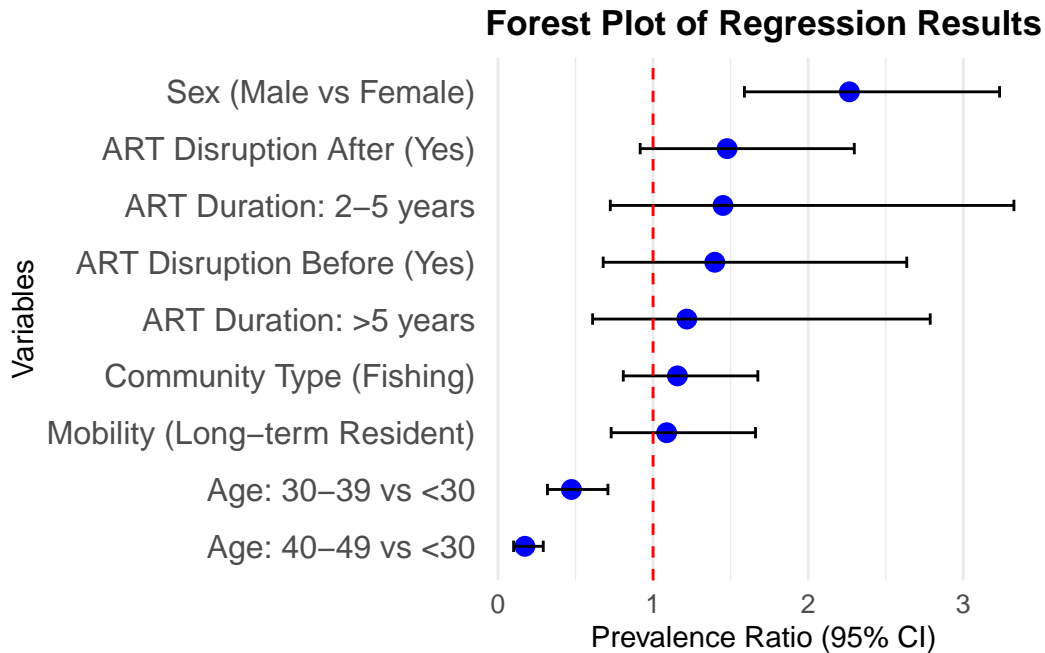
model stratified by sex

```
model_nb_sex <- df_viraemia %>%
  group_by(sex) %>%
  nest() %>%
  mutate(
    model = map(data, ~ glm.nb(viraemia_after_dum ~ any_disruption_after + any_disruption_b4
                               age_cat + mobility + community_type + art_duration,
                          data = .x)),
    results = map(model, tidy) ,
    ci = map(model, ~ confint(.x) %>% as_tibble()),
    ci = map(ci, ~ .x %>%
                   rename(ci.lower = `2.5 %`, ci.upper = `97.5 %`))
  )
```

```
model_nb_sex %>% select(sex, results,ci)
```