

Can HIV Self-Testing Reach First-Time Testers? A Telephone Survey Among Self-Test End Users in Côte d'Ivoire, Mali, and Senegal

Arsène Kra Kouassi et al.

2023-09-14

Contents

0.1	Elements for Table 1. Number of completed questionnaires, by distribution channel and country.	2
0.2	Table 2. Socio-demographic characteristics of the study participants peer HIV testing history.	3
0.3	Table 3. Participants' Perceived Health, HIV Risk, Sexual Behavior, and Condom Use in Relation to HIV Testing History	7
0.4	Table 4. Primary/secondary distribution, HIVST use, reported difficulties with HIVST peer HIV testing history	9
0.5	Table 5. Proportion of first-time testers among surveyed HIVST users and associated factors (univariate and multivariate logistic regression)	12
0.6	Additional file 2. Origin of phone calls and final status	18
0.7	Additional file 3. Sex of sexual partners and how HIVST was obtained, per distribution channel and sex.	19
0.8	Additional file 4. Average marginal predictions from the reduced logistic model of the probability of being a first-time tester	20
0.9	Additional file 5. Proportion of first-testers (percentage [95% confidence interval, n]) per age group, primary or secondary distribution, country, distribution channel and sex.	22

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.2      v readr      2.1.4
## v forcats    1.0.0      v stringr   1.5.0
## v ggplot2    3.4.3      v tibble    3.2.1
## v lubridate  1.9.2      v tidyr     1.3.0
## v purrr      1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(labelled)
library(gtsummary)
```

```
## #Uighur
```

```
library(nnet)
library(broom.helpers)
```

```
##
## Attachement du package : 'broom.helpers'
##
## L'objet suivant est masqué depuis 'package:gtsummary':
##
##     all_continuous
```

```
library(patchwork)
library(ggstats)
data <- readr::read_csv("data.csv", show_col_types = FALSE)
theme_gtsummary_language("en", big.mark = " ")
```

```
## Setting theme 'language: en'
```

0.1 Elements for Table 1. Number of completed questionnaires, by distribution channel and country.

```
data$delivery_channel_grouped <-
  data$delivery_channel_grouped |>
  fct_relevel(
    "FSW-based channels",
    "MSM-based channels",
    "Other delivery channels"
  )
data$delivery_channel <-
  data$delivery_channel |>
  fct_relevel(
    "outreach activities prioritising FSW",
    "FSW clinics",
    "outreach activities prioritising MSM",
    "MSM clinics",
    "STI consultations",
    "index testing",
    "outreach activities prioritising PWUD",
    "PWUD clinics"
  )
data <- data |>
  set_variable_labels(
    delivery_channel = "HIVST distribution channel",
    delivery_channel_grouped = "HIVST distribution channel"
```

```

)

data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    include = c(delivery_channel_grouped, delivery_channel),
    by = country,
    statistic = ~"{n}"
  ) |>
  add_overall(last = TRUE) |>
  bold_labels()

```

Table printed with 'knitr::kable()', not {gt}. Learn why at
 ## <https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	Côte d'Ivoire, N = 1 390	Mali, N = 984	Senegal, N = 241	Overall, N = 2 615
HIVST distribution channel				
FSW-based channels	584	629	92	1 305
MSM-based channels	723	335	42	1 100
Other delivery channels	83	20	107	210
HIVST distribution channel				
outreach activities	570	551	92	1 213
prioritising FSW				
FSW clinics	14	78	0	92
outreach activities	706	324	42	1 072
prioritising MSM				
MSM clinics	17	11	0	28
STI consultations	29	10	50	89
index testing	20	10	9	39
outreach activities	31	0	23	54
prioritising PWUD				
PWUD clinics	3	0	25	28

Note: the number of HIVST distributed per channel and country during the survey period were obtained from implementing partners' reports.

0.2 Table 2. Socio-demographic characteristics of the study participants peer HIV testing history.

```

data$delivery_channel_sex <- interaction(data$delivery_channel_grouped, data$sex)

data <- data |>
  mutate(
    delivery_channel_sex = delivery_channel_sex |>
    fct_recode(

```

```

      "man / MSM-based channels" = "MSM-based channels.man",
      "man / other delivery channels" = "Other delivery channels.man",
      "man / FSW-based channels" = "FSW-based channels.man",
      "man / other delivery channels" = "Autre_canal.man",
      "woman / MSM-based channels" = "MSM-based channels.woman",
      "woman / other delivery channels" = "Other delivery channels.woman",
      "woman / FSW-based channels" = "FSW-based channels.woman",
      "woman / other delivery channels" = "Autre_canal.woman"
    ) |>
    fct_relevel(
      "man / FSW-based channels",
      "woman / FSW-based channels",
      "man / MSM-based channels",
      "woman / MSM-based channels",
      "man / other delivery channels",
      "woman / other delivery channels"
    ),
    marital_status = marital_status |>
      fct_relevel(
        "single",
        "divorced / separated / widowed",
        "living with partner / married"
      ),
    educational_level = educational_level |>
      fct_relevel(
        "none / primary",
        "secondary",
        "higher"
      ),
    perceived_poverty = perceived_poverty |>
      fct_drop() |>
      fct_relevel(
        "you are comfortable",
        "your income is enough",
        "you are poor",
        "you are very poor"
      ),
    last_HIV_test = last_HIV_test |>
      fct_relevel(
        "never tested before (first-time testers)",
        "12 months or more",
        "less than 12 months"
      )
  )

data <- data |>
  set_variable_labels(
    country = "Country",
    sex = "Sex",
    age_group = "Age group",
    delivery_channel_sex = "Sex & distribution channel",
    educational_level = "Educational level",

```

```

    marital_status = "Marital status",
    perceived_poverty = "Financially, would you say that",
    last_HIV_test = "Last HIV test before using HIVST",
    exposed_risk_HIV = "How much do you think that you are exposed to the risk of acquiring HIV?"
  )

participants_profile_a <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(country, age_group, delivery_channel_sex, marital_status, educational_level, perceived_poverty),
    digits = ~ c(0, 1)
  ) |>
  add_overall(last = TRUE) |>
  bold_labels() |>
  modify_column_hide(c("stat_1", "stat_2", "stat_3"))

cross_table_a <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(country, age_group, delivery_channel_sex, marital_status, educational_level, perceived_poverty),
    digits = ~ c(0, 1),
    percent = "row"
  ) |>
  add_p() |>
  bold_labels()

tbl_merge(
  list(participants_profile_a, cross_table_a),
  tab_spanner = c("**Profile of participants**", "**HIV testing history**")
)

```

Table printed with 'knitr::kable()', not {gt}. Learn why at
 ## <https://www.danielsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
Country					<0.001
Côte d'Ivoire	1 390 (53.2%)	446 (32.1%)	308 (22.2%)	636 (45.8%)	
Mali	984 (37.6%)	558 (56.7%)	148 (15.0%)	278 (28.3%)	
Senegal	241 (9.2%)	74 (30.7%)	78 (32.4%)	89 (36.9%)	
Age group					<0.001
24 years or less	1 164 (44.5%)	637 (54.7%)	148 (12.7%)	379 (32.6%)	

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
25-34 years	1 063 (40.7%)	339 (31.9%)	260 (24.5%)	464 (43.7%)	<0.001
35 years or more	388 (14.8%)	102 (26.3%)	126 (32.5%)	160 (41.2%)	
Sex & distribution channel					
man / FSW-based channels	620 (23.7%)	261 (42.1%)	145 (23.4%)	214 (34.5%)	
woman / FSW-based channels	685 (26.2%)	264 (38.5%)	161 (23.5%)	260 (38.0%)	
man / MSM-based channels	997 (38.1%)	453 (45.4%)	139 (13.9%)	405 (40.6%)	
woman / MSM-based channels	103 (3.9%)	33 (32.0%)	22 (21.4%)	48 (46.6%)	
man / other delivery channels	137 (5.2%)	45 (32.8%)	45 (32.8%)	47 (34.3%)	
woman / other delivery channels	73 (2.8%)	22 (30.1%)	22 (30.1%)	29 (39.7%)	
Marital status					0.013
single	1 761 (67.3%)	733 (41.6%)	332 (18.9%)	696 (39.5%)	<0.001
divorced / separated / widowed	97 (3.7%)	31 (32.0%)	29 (29.9%)	37 (38.1%)	
living with partner / married	757 (28.9%)	314 (41.5%)	173 (22.9%)	270 (35.7%)	
Educational level					
none / primary	503 (19.2%)	239 (47.5%)	96 (19.1%)	168 (33.4%)	
secondary	1 432 (54.8%)	642 (44.8%)	291 (20.3%)	499 (34.8%)	
higher	680 (26.0%)	197 (29.0%)	147 (21.6%)	336 (49.4%)	
Financially, would you say that					
you are comfortable	449 (17.2%)	191 (42.5%)	57 (12.7%)	201 (44.8%)	
your income is enough	783 (29.9%)	296 (37.8%)	183 (23.4%)	304 (38.8%)	
you are poor	1 173 (44.9%)	485 (41.3%)	254 (21.7%)	434 (37.0%)	

you are very poor	210 (8.0%)	106 (50.5%)	40 (19.0%)	64 (30.5%)
----------------------	------------	-------------	------------	------------

0.3 Table 3. Participants' Perceived Health, HIV Risk, Sexual Behavior, and Condom Use in Relation to HIV Testing History

```
data <- data |>
  mutate(
    percieved_health = percieved_health |>
      fct_relevel(
        "very satisfactory",
        "quite satisfactory",
        "unsatisfactory",
        "not at all satisfactory"
      ),
    used_condom = used_condom |>
      fct_relevel(
        "always",
        "occasionally",
        "never",
        "did not have sex",
        "refusal"
      ),
    exposed_risk_HIV = exposed_risk_HIV |>
      fct_relevel(
        "highly exposed", "somewhat exposed", "not at all exposed"
      )
  )

data <- data |>
  set_variable_labels(
    percieved_health = "Compared to people of your age would you say your health is",
    exposed_risk_HIV = "How much do you think that you are exposed to the risk of acquiring HIV?",
    number_parten_sex = "Number of sexual partners in the last 12 months",
    used_condom = "Used condom in the last 12 months"
  )

participants_profile_b <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(
      percieved_health, exposed_risk_HIV,
      number_parten_sex, used_condom
    ),
    digits = ~ c(0, 1)
  ) |>
  add_overall(last = TRUE) |>
```

```

bold_labels() |>
modify_column_hide(c("stat_1", "stat_2", "stat_3"))

cross_table_b <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(
      percieved_health, exposed_risk_HIV,
      number_parten_sex, used_condom
    ),
    digits = ~ c(0, 1),
    percent = "row"
  ) |>
  add_p() |>
  bold_labels()

tbl_merge(
  list(participants_profile_b, cross_table_b),
  tab_spanner = c("**Profile of participants**", "**HIV testing history**")
)

```

Table printed with 'knitr::kable()', not {gt}. Learn why at
 ## <https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
Compared to people of your age would you say your health is					0.002
very satisfactory	1 549 (59.2%)	676 (43.6%)	282 (18.2%)	591 (38.2%)	
quite satisfactory	482 (18.4%)	180 (37.3%)	115 (23.9%)	187 (38.8%)	
unsatisfactory	475 (18.2%)	171 (36.0%)	119 (25.1%)	185 (38.9%)	
not at all satisfactory	109 (4.2%)	51 (46.8%)	18 (16.5%)	40 (36.7%)	
How much do you think that you are exposed to the risk of acquiring HIV?					<0.001
highly exposed	481 (18.4%)	217 (45.1%)	99 (20.6%)	165 (34.3%)	
somewhat exposed	824 (31.5%)	275 (33.4%)	212 (25.7%)	337 (40.9%)	
not at all exposed	1 310 (50.1%)	586 (44.7%)	223 (17.0%)	501 (38.2%)	

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
Number of sexual partners in the last 12 months					<0.001
0 partner	141 (5.4%)	88 (62.4%)	24 (17.0%)	29 (20.6%)	
1 to 2 partners	1 095 (41.9%)	444 (40.5%)	234 (21.4%)	417 (38.1%)	
3 to 6 partners	670 (25.6%)	243 (36.3%)	116 (17.3%)	311 (46.4%)	
7 partners or more	360 (13.8%)	132 (36.7%)	88 (24.4%)	140 (38.9%)	
DK-R	349 (13.3%)	171 (49.0%)	72 (20.6%)	106 (30.4%)	
Used condom in the last 12 months					<0.001
always	807 (30.9%)	294 (36.4%)	139 (17.2%)	374 (46.3%)	
occasionally	969 (37.1%)	335 (34.6%)	218 (22.5%)	416 (42.9%)	
never	633 (24.2%)	321 (50.7%)	144 (22.7%)	168 (26.5%)	
did not have sex	141 (5.4%)	88 (62.4%)	24 (17.0%)	29 (20.6%)	
refusal	65 (2.5%)	40 (61.5%)	9 (13.8%)	16 (24.6%)	

0.4 Table 4.Primary/secondary distribution, HIVST use, reported difficulties with HIVST peer HIV testing history

```
data <- data |>
  mutate(
    difficulty_comp_instruct = difficulty_comp_instruct |>
      fct_relevel(
        "yes", "no"
      ),
    difficulty_collecting_oral_fluid = difficulty_collecting_oral_fluid |>
      fct_relevel("yes", "no"),
    time_wait_reading_result = time_wait_reading_result |>
      fct_relevel(
        "under 20 min",
        "between 20 and 40 min",
        "more than 40 min",
        "do not know"
      ),
    difficulty_reading_result = difficulty_reading_result |>
      fct_relevel(
        "yes", "no"
      ),
  )
```

```

opinion_use_HIVST = opinion_use_HIVST |>
  fct_recode(
    "not simple / not at all simple" = "not simple",
    "not simple / not at all simple" = "not at all simple",
  ) |>
  fct_relevel(
    "very simple", "simple", "not simple / not at all simple"
  ),
opinion_reading_HIVST_result = opinion_reading_HIVST_result |>
  fct_relevel(
    "very easy", "easy", "not easy", "not at all easy"
  ),
opini_after_used_HIVST = opini_after_used_HIVST |>
  fct_relevel(
    "totally satisfied",
    "partially satisfied",
    "not satisfied",
    "not at all satisfied"
  )
)

data <- data |>
  set_variable_labels(
    primary_secondary_distribution = "How did you get the HIVST kit? Who gave you the HIVST kit?",
    difficulty_comp_instruct = "Did you have trouble understanding the instructions?",
    difficulty_collecting_oral_fluid = "Did you have difficulty collecting the oral fluid?",
    time_wait_reading_result = "How long did you wait before reading the result?",
    difficulty_reading_result = "Did you have difficulty reading the result?",
    opinion_use_HIVST = "Would you say that the use of HIVST was?",
    opinion_reading_HIVST_result = "Would you say that reading HIVST result was?",
    opini_after_used_HIVST = "After using HIVST, would you say that you are?"
  )

participants_profile_c <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(
      primary_secondary_distribution, difficulty_comp_instruct,
      difficulty_collecting_oral_fluid, time_wait_reading_result,
      difficulty_reading_result, opinion_use_HIVST,
      opinion_reading_HIVST_result, opini_after_used_HIVST
    ),
    digits = ~ c(0, 1),
    type = list(c(difficulty_reading_result, difficulty_comp_instruct,
      difficulty_collecting_oral_fluid) ~ "categorical")
  ) |>
  add_overall(last = TRUE) |>
  bold_labels() |>
  modify_column_hide(c("stat_1", "stat_2", "stat_3"))

```

```

cross_table_c <- data |>
  filter(final_status == "questionnaires completed") |>
  tbl_summary(
    by = last_HIV_test,
    include = c(
      primary_secondary_distribution, difficulty_comp_instruct,
      difficulty_collecting_oral_fluid, time_wait_reading_result,
      difficulty_reading_result, opinion_use_HIVST,
      opinion_reading_HIVST_result, opini_after_used_HIVST
    ),
    type = list(c(difficulty_reading_result, difficulty_comp_instruct, difficulty_collecting_oral_fluid,
      digits = ~ c(0, 1),
      percent = "row"
    ) |>
    add_p() |>
    bold_labels()

tbl_merge(
  list(participants_profile_c, cross_table_c),
  tab_spanner = c("**Profile of participants**", "**HIV testing history**")
)

```

Table printed with 'knitr::kable()', not {gt}. Learn why at
 ## <https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
How did you get the HIVST kit? Who gave you the HIVST kit?					0.003
primary distribution	1 815 (69.4%)	709 (39.1%)	380 (20.9%)	726 (40.0%)	
secondary distribution	800 (30.6%)	369 (46.1%)	154 (19.3%)	277 (34.6%)	
Did you have trouble understanding the instructions?					0.2
yes	69 (2.6%)	21 (30.4%)	15 (21.7%)	33 (47.8%)	
no	2 546 (97.4%)	1 057 (41.5%)	519 (20.4%)	970 (38.1%)	
Did you have difficulty collecting the oral fluid?					>0.9
yes	31 (1.2%)	12 (38.7%)	7 (22.6%)	12 (38.7%)	
no	2 584 (98.8%)	1 066 (41.3%)	527 (20.4%)	991 (38.4%)	

Characteristic	Overall, N = 2 615	never tested before (first-time testers), N = 1 078	12 months or more, N = 534	less than 12 months, N = 1 003	p- value
How long did you wait before reading the result?					0.3
under 20 min	528 (20.2%)	232 (43.9%)	98 (18.6%)	198 (37.5%)	
between 20 and 40 min	1 973 (75.4%)	794 (40.2%)	419 (21.2%)	760 (38.5%)	
more than 40 min	60 (2.3%)	25 (41.7%)	8 (13.3%)	27 (45.0%)	
do not know	54 (2.1%)	27 (50.0%)	9 (16.7%)	18 (33.3%)	
Did you have difficulty reading the result?					0.8
yes	66 (2.5%)	26 (39.4%)	12 (18.2%)	28 (42.4%)	
no	2 549 (97.5%)	1 052 (41.3%)	522 (20.5%)	975 (38.3%)	
Would you say that the use of HIVST was?					<0.001
very simple	1 482 (56.7%)	616 (41.6%)	262 (17.7%)	604 (40.8%)	
simple	1 092 (41.8%)	451 (41.3%)	265 (24.3%)	376 (34.4%)	
not simple / not at all simple	41 (1.6%)	11 (26.8%)	7 (17.1%)	23 (56.1%)	
Would you say that reading HIVST result was?					0.014
very easy	1 072 (41.0%)	462 (43.1%)	183 (17.1%)	427 (39.8%)	
easy	1 403 (53.7%)	567 (40.4%)	322 (23.0%)	514 (36.6%)	
not easy	108 (4.1%)	37 (34.3%)	22 (20.4%)	49 (45.4%)	
not at all easy	32 (1.2%)	12 (37.5%)	7 (21.9%)	13 (40.6%)	
After using HIVST, would you say that you are?					0.9
totally satisfied	2 329 (89.1%)	962 (41.3%)	477 (20.5%)	890 (38.2%)	
partially satisfied	269 (10.3%)	109 (40.5%)	52 (19.3%)	108 (40.1%)	
not satisfied	11 (0.4%)	4 (36.4%)	4 (36.4%)	3 (27.3%)	
not at all satisfied	6 (0.2%)	3 (50.0%)	1 (16.7%)	2 (33.3%)	

0.5 Table 5. Proportion of first-time testers among surveyed HIVST users and associated factors (univariate and multivariate logistic regression)

```
data <- data |>
  filter(final_status == "questionnaires completed") |>
```

```
mutate(
  first_testers = to_factor(first_testers),
  perceived_poverty_rec = perceived_poverty |>
    fct_recode(
      "you are poor/very poor" = "you are very poor",
      "you are poor/very poor" = "you are poor"
    )
)
```

```
variables <- c(
  "country", "sex", "delivery_channel_grouped", "age_group",
  "marital_status", "educational_level", "perceived_poverty_rec",
  "percieved_health", "exposed_risk_HIV", "number_parten_sex",
  "used_condom", "primary_secondary_distribution"
)
```

```
tbl_univariate <- data |>
  tbl_uvregression(
    method = glm,
    y = first_testers,
    include = all_of(variables),
    method.args = list(family = binomial),
    exponentiate = TRUE,
    pvalue_fun = ~ style_pvalue(.x, digits = 2)
  ) |>
  add_global_p() |>
  modify_column_hide(c("stat_n"))
```

```
model_formula <- as.formula(
  paste(
    "first_testers ~",
    paste(variables, collapse = " + "),
    "+ sex:delivery_channel_grouped"
  )
)
```

```
full_model <- glm(
  model_formula,
  data = data,
  family = binomial(logit),
)
```

```
reduced_model <- step(full_model)
```

```
## Start: AIC=3098.92
## first_testers ~ country + sex + delivery_channel_grouped + age_group +
## marital_status + educational_level + perceived_poverty_rec +
## percieved_health + exposed_risk_HIV + number_parten_sex +
## used_condom + primary_secondary_distribution + sex:delivery_channel_grouped
##
##               Df Deviance    AIC
## - marital_status      2  3041.6 3095.6
```

```

## - number_parten_sex          3    3044.2 3096.2
## - sex:delivery_channel_grouped 2    3042.4 3096.4
## <none>                        3040.9 3098.9
## - percieved_health          3    3047.8 3099.8
## - exposed_risk_HIV          2    3046.2 3100.2
## - perceived_poverty_rec      2    3047.3 3101.3
## - primary_secondary_distribution 1    3048.5 3104.5
## - used_condom               3    3076.3 3128.3
## - educational_level          2    3100.2 3154.2
## - country                   2    3156.3 3210.3
## - age_group                 2    3176.8 3230.8
##
## Step:  AIC=3095.56
## first_testers ~ country + sex + delivery_channel_grouped + age_group +
##   educational_level + perceived_poverty_rec + percieved_health +
##   exposed_risk_HIV + number_parten_sex + used_condom + primary_secondary_distribution +
##   sex:delivery_channel_grouped
##
##               Df Deviance    AIC
## - number_parten_sex          3    3044.8 3092.8
## - sex:delivery_channel_grouped 2    3042.9 3092.9
## <none>                        3041.6 3095.6
## - percieved_health          3    3048.3 3096.3
## - exposed_risk_HIV          2    3046.8 3096.8
## - perceived_poverty_rec      2    3047.8 3097.8
## - primary_secondary_distribution 1    3048.9 3100.9
## - used_condom               3    3079.8 3127.8
## - educational_level          2    3101.0 3151.0
## - country                   2    3160.4 3210.4
## - age_group                 2    3179.4 3229.4
##
## Step:  AIC=3092.79
## first_testers ~ country + sex + delivery_channel_grouped + age_group +
##   educational_level + perceived_poverty_rec + percieved_health +
##   exposed_risk_HIV + used_condom + primary_secondary_distribution +
##   sex:delivery_channel_grouped
##
##               Df Deviance    AIC
## - sex:delivery_channel_grouped 2    3046.2 3090.2
## <none>                        3044.8 3092.8
## - percieved_health          3    3051.4 3093.4
## - exposed_risk_HIV          2    3050.3 3094.3
## - perceived_poverty_rec      2    3051.0 3095.0
## - primary_secondary_distribution 1    3052.3 3098.3
## - used_condom               4    3102.9 3142.9
## - educational_level          2    3105.7 3149.7
## - country                   2    3170.9 3214.9
## - age_group                 2    3182.1 3226.1
##
## Step:  AIC=3090.2
## first_testers ~ country + sex + delivery_channel_grouped + age_group +
##   educational_level + perceived_poverty_rec + percieved_health +
##   exposed_risk_HIV + used_condom + primary_secondary_distribution
##

```

```
##
## - delivery_channel_grouped      2  3047.2 3087.2
## <none>                          3046.2 3090.2
## - percieved_health              3  3052.8 3090.8
## - exposed_risk_HIV              2  3051.7 3091.7
## - perceived_poverty_rec         2  3052.5 3092.5
## - primary_secondary_distribution 1  3053.4 3095.4
## - sex                           1  3085.0 3127.0
## - used_condom                   4  3104.2 3140.2
## - educational_level             2  3108.4 3148.4
## - country                       2  3173.0 3213.0
## - age_group                     2  3183.5 3223.5
##
## Step: AIC=3087.15
## first_testers ~ country + sex + age_group + educational_level +
##   perceived_poverty_rec + percieved_health + exposed_risk_HIV +
##   used_condom + primary_secondary_distribution
##
##
## Df Deviance  AIC
## <none>      3047.2 3087.2
## - percieved_health      3  3053.8 3087.8
## - exposed_risk_HIV      2  3052.6 3088.6
## - perceived_poverty_rec  2  3053.3 3089.3
## - primary_secondary_distribution 1  3054.7 3092.7
## - sex                  1  3094.8 3132.8
## - used_condom           4  3105.8 3137.8
## - educational_level     2  3108.8 3144.8
## - country               2  3175.6 3211.6
## - age_group             2  3191.6 3227.6
```

```
tbl_multivariate <- reduced_model |>
  tbl_regression(exponentiate = TRUE) |>
  add_global_p()
```

```
tbl_descriptive <-
  data |>
  tbl_summary(
    by = first_testers,
    include = all_of(variables),
    statistic = all_categorical() ~ "{p}% ({n}/{N})",
    percent = "row",
    digits = all_categorical() ~ c(1, 0, 0)
  ) |>
  modify_column_hide("stat_1") |>
  modify_header("stat_2" ~ "***Never tested before**")

list(tbl_descriptive, tbl_univariate, tbl_multivariate) |>
  tbl_merge(
    tab_spanner = c(
      NA,
      "**Univariate regressions**",
      "**Multivariate regression**"
    )
  )
```

```
) |>
bold_labels()
```

```
## Table printed with 'knitr::kable()', not {gt}. Learn why at
## https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html
## To suppress this message, include 'message = FALSE' in code chunk header.
```

Characteristic	Never tested before	OR	95% CI	p- value	OR	95% CI	p- value
Country				<0.001			<0.001
Côte d'Ivoire	32.1% (446/1 390)	—	—		—	—	
Mali	56.7% (558/984)	2.77	2.34, 3.28		2.95	2.42, 3.60	
Senegal	30.7% (74/241)	0.94	0.69, 1.26		1.03	0.73, 1.45	
Sex				0.002			<0.001
man	43.3% (759/1 754)	—	—		—	—	
woman	37.0% (319/861)	0.77	0.65, 0.91		0.49	0.40, 0.60	
HIVST distribution channel				0.002			
FSW-based channels	40.2% (525/1 305)	—	—				
MSM-based channels	44.2% (486/1 100)	1.18	1.00, 1.38				
Other delivery channels	31.9% (67/210)	0.70	0.51, 0.95				
Age group				<0.001			<0.001
24 years or less	54.7% (637/1 164)	—	—		—	—	
25-34 years	31.9% (339/1 063)	0.39	0.33, 0.46		0.37	0.30, 0.44	
35 years or more	26.3% (102/388)	0.30	0.23, 0.38		0.28	0.21, 0.37	
Marital status				0.16			
single	41.6% (733/1 761)	—	—				
divorced / separated / widowed	32.0% (31/97)	0.66	0.42, 1.01				
living with partner / married	41.5% (314/757)	0.99	0.84, 1.18				
Educational level				<0.001			<0.001
none / primary	47.5% (239/503)	—	—		—	—	
secondary	44.8% (642/1 432)	0.90	0.73, 1.10		0.60	0.47, 0.77	
higher	29.0% (197/680)	0.45	0.35, 0.57		0.33	0.25, 0.44	
Financially, would you say that				0.066			0.045

Characteristic	Never tested before	OR	95% CI	p- value	OR	95% CI	p- value
you are comfortable	42.5% (191/449)	—	—		—	—	
your income is enough	37.8% (296/783)	0.82	0.65, 1.04		0.73	0.56, 0.95	
you are poor/very poor	42.7% (591/1 383)	1.01	0.81, 1.25		0.88	0.69, 1.12	
Compared to people of your age would you say your health is				0.004			0.086
very satisfactory	43.6% (676/1 549)	—	—		—	—	
quite satisfactory	37.3% (180/482)	0.77	0.62, 0.95		0.98	0.78, 1.24	
unsatisfactory	36.0% (171/475)	0.73	0.59, 0.90		0.97	0.76, 1.23	
not at all satisfactory	46.8% (51/109)	1.14	0.77, 1.68		1.71	1.12, 2.62	
How much do you think that you are exposed to the risk of acquiring HIV?				<0.001			0.066
highly exposed	45.1% (217/481)	—	—		—	—	
somewhat exposed	33.4% (275/824)	0.61	0.48, 0.77		0.77	0.60, 1.00	
not at all exposed	44.7% (586/1 310)	0.98	0.80, 1.22		0.96	0.76, 1.22	
Number of sexual partners in the last 12 months				<0.001			
0 partner	62.4% (88/141)	—	—				
1 to 2 partners	40.5% (444/1 095)	0.41	0.28, 0.59				
3 to 6 partners	36.3% (243/670)	0.34	0.23, 0.50				
7 partners or more	36.7% (132/360)	0.35	0.23, 0.52				
DK-R	49.0% (171/349)	0.58	0.39, 0.86				
Used condom in the last 12 months				<0.001			<0.001
always	36.4% (294/807)	—	—		—	—	
occasionally	34.6% (335/969)	0.92	0.76, 1.12		1.13	0.91, 1.41	
never	50.7% (321/633)	1.80	1.45, 2.22		2.02	1.59, 2.56	
did not have sex	62.4% (88/141)	2.90	2.01, 4.21		2.88	1.91, 4.38	
refusal	61.5% (40/65)	2.79	1.67, 4.75		2.58	1.45, 4.65	
How did you get the HIVST kit? Who gave you the HIVST kit?				<0.001			0.006

Characteristic	Never tested before	OR	95% CI	p-value	OR	95% CI	p-value
primary distribution	39.1% (709/1 815)	—	—		—	—	
secondary distribution	46.1% (369/800)	1.34	1.13, 1.58		1.32	1.08, 1.60	

0.6 Additional file 2. Origin of phone calls and final status

```
data <- data |>
  mutate(
    calls_origin = calls_origin |>
      fct_relevel(
        "Calls initiated by the participant through the hotline",
        "Call back by a surveyor after a missed call or a message sent by the participant"
      ),
    final_status = final_status |>
      fct_relevel(
        "not recontactable after appointment",
        "dropped out before the end",
        "not eligible: not old enough",
        "not eligible: leaflet number not valid",
        "not eligible: has already participated in the survey",
        "questionnaires completed"
      )
  ) |>
  set_variable_labels(
    country = "Country",
    calls_origin = "Origin of the calls",
    final_status = "Final status"
  )
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'final_status = fct_relevel(...)'.
```

Caused by warning:

```
## ! 5 unknown levels in 'f': not recontactable after appointment, dropped out
## before the end, not eligible: not old enough, not eligible: leaflet number not
## valid, and not eligible: has already participated in the survey
```

```
data |>
  tbl_summary(
    include = c(calls_origin, final_status),
    by = country,
    digits = ~ c(0, 1)
  ) |>
  add_overall() |>
  bold_labels()
```

```
## Table printed with 'knitr::kable()', not {gt}. Learn why at
```

<https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	Overall, N = 2 615	Côte d'Ivoire, N = 1 390	Mali, N = 984	Senegal, N = 241
Origin of the calls				
Calls initiated by the participant through the hotline	2 551 (97.6%)	1 372 (98.7%)	964 (98.0%)	215 (89.2%)
Call back by a surveyor after a missed call or a message sent by the participant	64 (2.4%)	18 (1.3%)	20 (2.0%)	26 (10.8%)
Final status				
questionnaires completed	2 615 (100.0%)	1 390 (100.0%)	984 (100.0%)	241 (100.0%)

0.7 Additional file 3. Sex of sexual partners and how HIVST was obtained, per distribution channel and sex.

```
data <- data |>
  mutate(
    sex_reported = sex_reported |>
      fct_relevel(
        "never had sex",
        "partners of opposite sex only",
        "both men and women",
        "partners of same sex only",
        "DK-R"
      )
  )

#
data <- data |>
  set_variable_labels(
    sex_reported = "Sex of reported sexual partners (lifetime)",
    distribution_type = "How did you get the HIVST kit? Who gave you the HIVST kit?"
  )

data |>
  tbl_summary(
    by = delivery_channel_sex,
    include = c(
      sex_reported,
      distribution_type
    ),
    digits = ~ c(0, 1)
  ) |>
  add_overall(last = TRUE) |>
  bold_labels()
```

Table printed with 'knitr::kable()', not {gt}. Learn why at
 ## <https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html>
 ## To suppress this message, include 'message = FALSE' in code chunk header.

Characteristic	man / FSW- based chan- nels, N = 620	woman / FSW- based channels, N = 685	man / MSM- based chan- nels, N = 997	woman / MSM- based channels, N = 103	man / other delivery channels, N = 137	woman / other delivery channels, N = 73	Overall, N = 2 615
Sex of reported sexual partners (lifetime)							
never had sex	23 (3.7%)	47 (6.9%)	31 (3.1%)	7 (6.8%)	4 (2.9%)	6 (8.2%)	118 (4.5%)
partners of opposite sex only	515 (83.1%)	577 (84.2%)	453 (45.4%)	72 (69.9%)	117 (85.4%)	66 (90.4%)	1 800 (68.8%)
both men and women	36 (5.8%)	27 (3.9%)	334 (33.5%)	12 (11.7%)	8 (5.8%)	0 (0.0%)	417 (15.9%)
partners of same sex only	36 (5.8%)	16 (2.3%)	160 (16.0%)	8 (7.8%)	6 (4.4%)	1 (1.4%)	227 (8.7%)
DK-R	10 (1.6%)	18 (2.6%)	19 (1.9%)	4 (3.9%)	2 (1.5%)	0 (0.0%)	53 (2.0%)
How did you get the HIVST kit? Who gave you the HIVST kit?							
colleague	5 (0.8%)	3 (0.4%)	4 (0.4%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	13 (0.5%)
community agent / peer-educator	356 (57.4%)	537 (78.4%)	474 (47.5%)	51 (49.5%)	50 (36.5%)	18 (24.7%)	1 486 (56.8%)
friend	82 (13.2%)	36 (5.3%)	270 (27.1%)	23 (22.3%)	14 (10.2%)	3 (4.1%)	428 (16.4%)
health professional	69 (11.1%)	76 (11.1%)	77 (7.7%)	12 (11.7%)	49 (35.8%)	46 (63.0%)	329 (12.6%)
relative	55 (8.9%)	30 (4.4%)	57 (5.7%)	9 (8.7%)	11 (8.0%)	1 (1.4%)	163 (6.2%)
sexual partner	53 (8.5%)	3 (0.4%)	115 (11.5%)	8 (7.8%)	12 (8.8%)	5 (6.8%)	196 (7.5%)

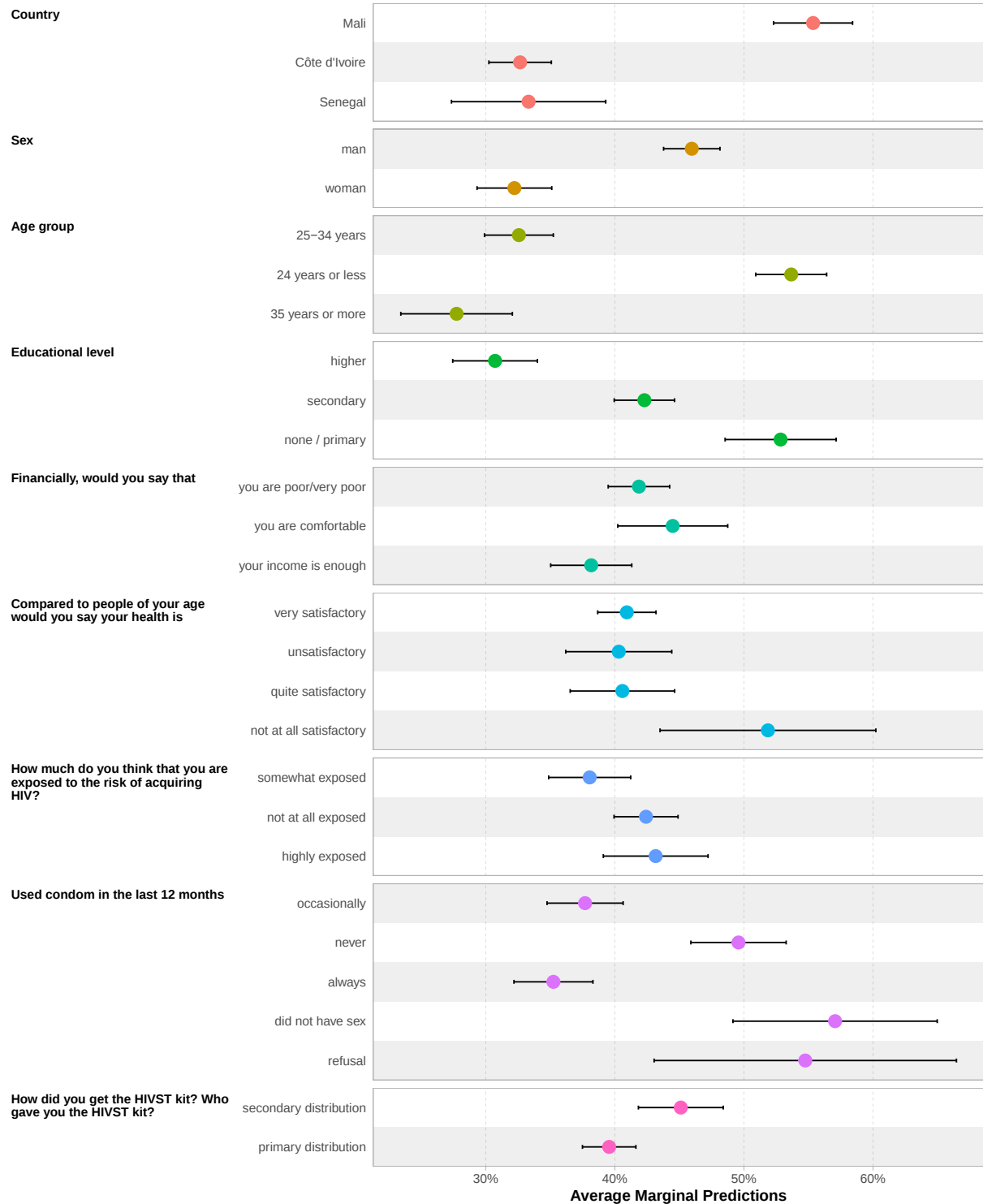
0.8 Additional file 4. Average marginal predictions from the reduced logistic model of the probability of being a first-time tester

```
reduced_model |>
  ggstats::ggcoef_model(
    tidy_fun = broom.helpers::tidy_marginal_predictions,
    tidy_args = list(type = "response"),
    show_p_values = FALSE,
    signif_stars = FALSE,
```

```

significance = NULL,
vline = FALSE,
facet_labeller = ggplot2::label_wrap_gen(35)
) +
scale_x_continuous(labels = scales::label_percent())

```



0.9 Additional file 5. Proportion of first-testers (percentage [95% confidence interval, n]) per age group, primary or secondary distribution, country, distribution channel and sex.

```
data$delivery_channel_by_sex <- interaction(data$sex, data$delivery_channel_grouped)

data <- data |>
  set_variable_labels(
    primary_secondary_distribution = "Distribution type",
    age_group = "Age group",
    country = "Country"
  )

data |>
  filter(final_status == "questionnaires completed") |>
  tbl_custom_summary(
    include = c(age_group, primary_secondary_distribution, educational_level, country),
    by = delivery_channel_by_sex,
    stat_fns = ~ proportion_summary("first_testers", "yes"),
    statistic = ~"{prop}% [{conf.low}-{conf.high}, n={N}]",
    digits = ~ list(
      function(x) {
        style_percent(x, digits = 1)
      },
      style_percent,
      style_percent,
      0
    ),
    overall_row = TRUE,
    overall_row_last = TRUE
  ) |>
  add_overall(last = TRUE)
```

```
## Warning: There were 5 warnings in 'mutate()'.
## The first warning was:
## i In argument: 'df_stats = pmap(...)'.
## Caused by warning in 'stats::prop.test()':
## ! L'approximation du Chi-2 est peut-être incorrecte
## i Run 'dplyr::last_dplyr_warnings()' to see the 4 remaining warnings.
```

```
## Table printed with 'knitr::kable()', not {gt}. Learn why at
## https://www.danielsjoberg.com/gtsummary/articles/rmarkdown.html
## To suppress this message, include 'message = FALSE' in code chunk header.
```

	man.FSW- based channels, N = 620	woman.FSW- based channels, N = 685	man.MSM- based channels, N = 997	woman.MSM- based channels, N = 103	man.Other delivery channels, N = 137	woman.Other delivery channels, N = 73	Overall, N = 2 615
--	---	---	---	---	---	--	--------------------------

Age
group

Characteristics	man.FSW- based channels, N = 620	woman.FSW- based channels, N = 685	man.MSM- based channels, N = 997	woman.MSM- based channels, N = 103	man.Other delivery channels, N = 137	woman.Other delivery channels, N = 73	Overall, N = 2 615
24 years or less	56.0% [49-63, n=225]	52.2% [46-58, n=274]	57.5% [53-62, n=550]	40.3% [29-53, n=72]	65.0% [41-84, n=20]	43.5% [24-65, n=23]	54.7% [52-58, n=1 164]
25-34 years	36.4% [31-43, n=269]	30.1% [25-36, n=296]	30.6% [26-35, n=402]	16.7% [5.5-38, n=24]	40.8% [27-56, n=49]	21.7% [8.3-44, n=23]	31.9% [29-35, n=1 063]
35 years or more	29.4% [22-38, n=126]	27.8% [20-37, n=115]	31.1% [19-47, n=45]	0% [0-44, n=7]	17.6% [9.8-29, n=68]	25.9% [12-47, n=27]	26.3% [22-31, n=388]
Distribution type							
primary distribution	38.8% [34-44, n=425]	39.3% [35-43, n=613]	42.3% [38-47, n=551]	34.9% [24-48, n=63]	30.3% [22-40, n=99]	28.1% [18-41, n=64]	39.1% [37-41, n=1 815]
secondary distribution	49.2% [42-56, n=195]	31.9% [22-44, n=72]	49.3% [45-54, n=446]	27.5% [15-44, n=40]	39.5% [24-57, n=38]	44.4% [15-77, n=9]	46.1% [43-50, n=800]
Educational level							
none / primary	51.1% [40-62, n=88]	44.5% [38-51, n=254]	54.8% [44-65, n=93]	50.0% [22-78, n=8]	45.2% [28-64, n=31]	41.4% [24-61, n=29]	47.5% [43-52, n=503]
secondary	45.2% [40-51, n=345]	35.7% [31-41, n=350]	53.8% [50-58, n=573]	31.0% [21-43, n=71]	38.5% [27-51, n=65]	21.4% [9.0-41, n=28]	44.8% [42-47, n=1 432]
higher	32.1% [26-39, n=187]	32.1% [22-44, n=81]	28.4% [24-34, n=331]	29.2% [13-51, n=24]	14.6% [6.1-30, n=41]	25.0% [8.3-53, n=16]	29.0% [26-33, n=680]
Country							
Côte d'Ivoire	31.9% [27-37, n=339]	25.7% [20-32, n=245]	36.6% [33-40, n=650]	28.8% [19-41, n=73]	20.0% [11-33, n=60]	17.4% [5.7-40, n=23]	32.1% [30-35, n=1 390]
Mali	54.6% [48-61, n=269]	50.3% [45-56, n=360]	67.0% [61-72, n=306]	41.4% [24-61, n=29]	72.7% [39-93, n=11]	55.6% [23-85, n=9]	56.7% [54-60, n=984]
Senegal	50.0% [25-75, n=12]	25.0% [16-36, n=80]	24.4% [13-41, n=41]	0% [0-95, n=1]	37.9% [26-51, n=66]	31.7% [19-48, n=41]	30.7% [25-37, n=241]
Overall	42.1% [38-46, n=620]	38.5% [35-42, n=685]	45.4% [42-49, n=997]	32.0% [23-42, n=103]	32.8% [25-41, n=137]	30.1% [20-42, n=73]	41.2% [39-43, n=2 615]