

# Quasi-experiment

Hafiz

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```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.4      v readr      2.1.5
## v forcats    1.0.0      v stringr   1.5.1
## v ggplot2     3.5.2      v tibble    3.3.0
## v lubridate  1.9.4      v tidyr     1.3.1
## v purrr       1.0.4
## -- 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(janitor)
```

```
##
## Attaching package: 'janitor'
##
## The following objects are masked from 'package:stats':
##
##   chisq.test, fisher.test
```

```
library(readxl)
library(dplyr)
library(ggplot2)
library(janitor)
# 1. Read the CSV with proper headers and encoding
df <- read_excel("Dataset/SMC_VAS BAUCHI BASELINE SURVEY 2025_Cleaned_version.xlsx")
```

```
## Warning: Expecting numeric in ZW95 / R95C699: got a date
```

```
## Warning: Expecting numeric in ZW97 / R97C699: got a date
```

```
## Warning: Expecting numeric in ACK216 / R216C765: got a date
```

```
## Warning: Expecting numeric in ZW237 / R237C699: got a date
```

```
## Warning: Expecting numeric in ZW449 / R449C699: got a date
```

## Warning: Expecting numeric in ZW985 / R985C699: got a date

## Warning: Expecting numeric in ZW987 / R987C699: got a date

## Warning: Expecting numeric in ZW1074 / R1074C699: got a date

## Warning: Expecting logical in ACV1074 / R1074C776: got 'Was not given'

## Warning: Expecting numeric in ZW1079 / R1079C699: got a date

## Warning: Expecting logical in ACJ1079 / R1079C764: got 'None'

## Warning: Expecting logical in DU1108 / R1108C125: got 'No'

## Warning: Expecting logical in ACJ1152 / R1152C764: got 'Was not expecting any'

## Warning: Expecting logical in ACV1152 / R1152C776: got 'Was not expecting any'

## Warning: Expecting logical in AIW1255 / R1255C933: got 'Village head house'

## Warning: Expecting numeric in ZW1302 / R1302C699: got a date

## Warning: Expecting logical in AAF1302 / R1302C708: got 'Fati only received the  
## Red dose of the Vitamin A supplement'

## Warning: Expecting logical in AGH1303 / R1303C866: got 'I was told that such  
## reactions might happen by the health facility workers'

## Warning: Expecting numeric in ZW1306 / R1306C699: got '2 3 4 5'

## Warning: Expecting numeric in AAG1306 / R1306C709: got a date

## Warning: Expecting logical in AAR1306 / R1306C720: got 'Not Aware'

## Warning: Expecting numeric in ZW1324 / R1324C699: got a date

## Warning: Expecting numeric in ZW1475 / R1475C699: got a date

## Warning: Expecting logical in ACJ1475 / R1475C764: got 'Non'

## Warning: Expecting logical in AAF1565 / R1565C708: got 'I donâ€t know'

## Warning: Expecting logical in AAR1565 / R1565C720: got 'I donâ€t know'

## Warning: Expecting logical in ACJ1565 / R1565C764: got 'I donâ€t know'

## Warning: Expecting logical in ACV1565 / R1565C776: got 'I donâ€t know'

## Warning: Expecting logical in AAF1571 / R1571C708: got 'I donâ€t know'

## Warning: Expecting logical in ACJ1571 / R1571C764: got 'I donâ€t know'

## Warning: Expecting logical in AIW1638 / R1638C933: got 'Not MNCHW'

## Warning: Expecting logical in AEL1639 / R1639C818: got 'Cultural belief that  
## community distributed'

## Warning: Expecting logical in AGH1639 / R1639C866: got 'Non'

## Warning: Expecting logical in DU2115 / R2115C125: got 'No'

## Warning: Expecting numeric in ZW2181 / R2181C699: got a date

## Warning: Expecting numeric in ZW2186 / R2186C699: got a date

## Warning: Expecting numeric in ZW2188 / R2188C699: got a date

## Warning: Expecting numeric in ZW2192 / R2192C699: got a date

## Warning: Expecting numeric in ACK2192 / R2192C765: got a date

## Warning: Expecting numeric in ZW2193 / R2193C699: got a date

## Warning: Expecting numeric in ZW2194 / R2194C699: got a date

## Warning: Expecting numeric in ZW2196 / R2196C699: got a date

## Warning: Expecting numeric in ZW2197 / R2197C699: got a date

## Warning: Expecting numeric in ZW2198 / R2198C699: got a date

## Warning: Expecting numeric in ZW2200 / R2200C699: got a date

## Warning: Expecting numeric in ZW2202 / R2202C699: got a date

## Warning: Expecting numeric in ZW2203 / R2203C699: got a date

## Warning: Expecting numeric in AF02332 / R2332C847: got a date

## Warning: Expecting logical in DU2372 / R2372C125: got 'No'

## Warning: Expecting logical in FI2372 / R2372C165: got 'No'

## Warning: Expecting numeric in AF02397 / R2397C847: got a date

## Warning: Expecting logical in TX2500 / R2500C544: got 'Interlock'

## Warning: Expecting logical in AAR2576 / R2576C720: got 'They said she was  
## ineligible'

## Warning: Expecting logical in ACJ2576 / R2576C764: got 'None'

## Warning: Expecting logical in ACV2576 / R2576C776: got 'None, received all I  
## wanted'

## Warning: Expecting logical in AAF2589 / R2589C708: got 'Don't know all about  
## all the services'

## Warning: Expecting logical in AAR2589 / R2589C720: got 'Don't know about all  
## the services I can access'

## Warning: Expecting logical in ACJ2589 / R2589C764: got 'Wasn't expecting  
## anything'

## Warning: Expecting numeric in ZW2640 / R2640C699: got '1 2 3 4'

## Warning: Expecting logical in AAR2640 / R2640C720: got 'Age of the child was  
## above the age limit'

## Warning: Expecting logical in ACJ2640 / R2640C764: got 'Above the age limit'

## Warning: Expecting logical in ACV2640 / R2640C776: got 'Age above'

## Warning: Expecting numeric in AF02645 / R2645C847: got a date

## Warning: Expecting numeric in ZW2684 / R2684C699: got '2 3 4 5'

## Warning: Expecting logical in AAR2684 / R2684C720: got 'My daughter really  
## needs it at that time'

## Warning: Expecting numeric in AF02704 / R2704C847: got a date

## Warning: Expecting numeric in ZW2993 / R2993C699: got '1 2 3 4'

## Warning: Expecting logical in AAF3038 / R3038C708: got 'Money'

## Warning: Expecting logical in AAR3038 / R3038C720: got 'It's not part of it'

## Warning: Expecting logical in ACJ3038 / R3038C764: got 'Handwork'

## Warning: Expecting logical in ACV3038 / R3038C776: got 'Service not available'

## Warning: Expecting logical in AAF3075 / R3075C708: got 'Typhoid,phenea'

## Warning: Expecting logical in ACJ3075 / R3075C764: got 'Non'

## Warning: Expecting logical in ACV3075 / R3075C776: got 'Non'

## Warning: Expecting logical in AAF3126 / R3126C708: got 'All'

## Warning: Expecting logical in ACJ3126 / R3126C764: got 'I don't know'

## Warning: Expecting logical in ACV3126 / R3126C776: got 'I wasn't present'

## Warning: Expecting logical in GT3181 / R3181C202: got 'Halima'

## Warning: Expecting logical in GX3181 / R3181C206: got 'Female'

## Warning: Expecting logical in HB3181 / R3181C210: got 'Wusna'

## Warning: Expecting logical in HE3181 / R3181C213: got 'No'

## Warning: Expecting logical in HF3181 / R3181C214: got 'Female'

## Warning: Expecting logical in HJ3181 / R3181C218: got 'Daiyaba'

## Warning: Expecting logical in HN3181 / R3181C222: got 'Female'

## Warning: Expecting logical in HR3181 / R3181C226: got 'Aisha'

## Warning: Expecting logical in HU3181 / R3181C229: got 'No'

## Warning: Expecting logical in HV3181 / R3181C230: got 'Female'

## Warning: Expecting logical in HZ3181 / R3181C234: got 'Murtala'

## Warning: Expecting logical in ID3181 / R3181C238: got 'Male'

## Warning: Expecting logical in IH3181 / R3181C242: got 'Harasu'

## Warning: Expecting logical in IL3181 / R3181C246: got 'Male'

## Warning: Expecting logical in IP3181 / R3181C250: got 'Garba'

## Warning: Expecting logical in IT3181 / R3181C254: got 'Male'

## Warning: Expecting logical in IX3181 / R3181C258: got 'Shaaban'

## Warning: Expecting logical in JB3181 / R3181C262: got 'Male'

## Warning: Expecting numeric in ZW3206 / R3206C699: got a date

## Warning: Expecting numeric in ZW3210 / R3210C699: got a date

## Warning: Expecting logical in GT3215 / R3215C202: got 'Nzaifi'

## Warning: Expecting logical in GX3215 / R3215C206: got 'Male'

## Warning: Expecting logical in HB3215 / R3215C210: got 'Badamasi'

## Warning: Expecting logical in HE3215 / R3215C213: got 'No'

## Warning: Expecting logical in HF3215 / R3215C214: got 'Male'

## Warning: Expecting logical in HJ3215 / R3215C218: got 'Karimatu'

## Warning: Expecting logical in HN3215 / R3215C222: got 'Female'

## Warning: Expecting logical in HR3215 / R3215C226: got 'Hadiza'

## Warning: Expecting logical in HV3215 / R3215C230: got 'Female'

## Warning: Expecting logical in HZ3215 / R3215C234: got 'Kabiru'

## Warning: Expecting logical in ID3215 / R3215C238: got 'Male'

## Warning: Expecting logical in IH3215 / R3215C242: got 'Ibrahim'

## Warning: Expecting logical in IL3215 / R3215C246: got 'Male'

## Warning: Expecting logical in IP3215 / R3215C250: got 'Nafisa'

## Warning: Expecting logical in IT3215 / R3215C254: got 'Female'

## Warning: Expecting logical in IX3215 / R3215C258: got 'Zaliha'

## Warning: Expecting logical in JB3215 / R3215C262: got 'Female'

## Warning: Expecting logical in JF3215 / R3215C266: got 'Zainab'

## Warning: Expecting logical in JJ3215 / R3215C270: got 'Female'

## Warning: Expecting logical in JN3215 / R3215C274: got 'Sadiya'

## Warning: Expecting logical in JR3215 / R3215C278: got 'Female'

## Warning: Expecting logical in OR3215 / R3215C408: got 'Hamsatu'

## Warning: Expecting logical in OT3215 / R3215C410: got 'Female'

## Warning: Expecting logical in OX3215 / R3215C414: got 'Sade'

## Warning: Expecting logical in OZ3215 / R3215C416: got 'Female'

## Warning: Expecting logical in PD3215 / R3215C420: got 'Balki'

## Warning: Expecting logical in PF3215 / R3215C422: got 'Female'

## Warning: Expecting logical in PJ3215 / R3215C426: got 'Bakiya'

## Warning: Expecting logical in PL3215 / R3215C428: got 'Female'

## Warning: Expecting logical in PP3215 / R3215C432: got 'Aisha'

## Warning: Expecting logical in PR3215 / R3215C434: got 'Female'

## Warning: Expecting numeric in AF03228 / R3228C847: got a date

## Warning: Expecting numeric in AF03231 / R3231C847: got a date

## Warning: Expecting numeric in ZW3255 / R3255C699: got a date

## Warning: Expecting logical in GT3328 / R3328C202: got 'Furaira'

## Warning: Expecting logical in GX3328 / R3328C206: got 'Female'

## Warning: Expecting logical in HB3328 / R3328C210: got 'Musa'

## Warning: Expecting logical in HF3328 / R3328C214: got 'Male'

## Warning: Expecting logical in HJ3328 / R3328C218: got 'Rukaya'

## Warning: Expecting logical in HN3328 / R3328C222: got 'Female'

## Warning: Expecting numeric in ZW3350 / R3350C699: got a date

## Warning: Expecting numeric in ACK3350 / R3350C765: got a date

## Warning: Expecting numeric in ZW3352 / R3352C699: got a date

## Warning: Expecting numeric in AAG3352 / R3352C709: got a date

## Warning: Expecting numeric in ZW3354 / R3354C699: got a date

## Warning: Expecting logical in AAR3379 / R3379C720: got 'Left on time'

## Warning: Expecting logical in ACJ3379 / R3379C764: got 'Non'

## Warning: Expecting logical in ACV3379 / R3379C776: got 'Was not expecting  
## anything'

## Warning: Expecting logical in AAF3382 / R3382C708: got 'Non'

## Warning: Expecting logical in AAR3382 / R3382C720: got 'Non'

## Warning: Expecting logical in ACV3382 / R3382C776: got 'Was given'

## Warning: Expecting numeric in AF03390 / R3390C847: got a date

## Warning: Expecting logical in GT3505 / R3505C202: got 'Nusaiba'

## Warning: Expecting logical in GX3505 / R3505C206: got 'Female'

## Warning: Expecting logical in HB3505 / R3505C210: got 'Yusuf'

## Warning: Expecting logical in HF3505 / R3505C214: got 'Male'

## Warning: Expecting logical in AIW3540 / R3540C933: got 'A visit to main phc  
## bununu'

## Warning: Expecting numeric in ZW3558 / R3558C699: got a date

## Warning: Expecting logical in DU3660 / R3660C125: got 'No'

## Warning: Expecting logical in AIW3689 / R3689C933: got 'Emir place'

## Warning: Expecting numeric in ZW3705 / R3705C699: got a date

## Warning: Expecting logical in DU3978 / R3978C125: got 'Yes'

## Warning: Expecting logical in AAF4362 / R4362C708: got 'Don't know all the  
## services'

## Warning: Expecting logical in ACJ4362 / R4362C764: got 'Didn't know the  
## services'

## Warning: Expecting numeric in ZW4705 / R4705C699: got a date

## Warning: Expecting numeric in AAG4705 / R4705C709: got a date

## Warning: Expecting numeric in ZW4713 / R4713C699: got a date

## Warning: Expecting numeric in ZW4763 / R4763C699: got '2 3 4 5 6'

## Warning: Expecting logical in DU4830 / R4830C125: got 'No'

## Warning: Expecting logical in AEL4843 / R4843C818: got 'Fear of side effects'

## Warning: Expecting logical in ES4862 / R4862C149: got 'Yes'



```

## Warning: Expecting logical in GT4862 / R4862C202: got 'Dauda'

## Warning: Expecting logical in GX4862 / R4862C206: got 'Male'

## Warning: Expecting logical in HB4862 / R4862C210: got 'Hauwa'

## Warning: Expecting logical in HF4862 / R4862C214: got 'Female'

## Warning: Expecting logical in HJ4862 / R4862C218: got 'Rakiya'

## Warning: Expecting logical in HN4862 / R4862C222: got 'Female'

## Warning: Expecting logical in HR4862 / R4862C226: got 'Idi'

## Warning: Expecting logical in HV4862 / R4862C230: got 'Male'

## Warning: Expecting logical in HZ4862 / R4862C234: got 'Sufwan'

## Warning: Expecting logical in ID4862 / R4862C238: got 'Male'

## Warning: Expecting logical in IH4862 / R4862C242: got 'Jidda'

## Warning: Expecting logical in IL4862 / R4862C246: got 'Female'

## Warning: Expecting logical in IP4862 / R4862C250: got 'Shafatu'

## Warning: Expecting logical in IT4862 / R4862C254: got 'Female'

## Warning: Expecting logical in IX4862 / R4862C258: got 'Mariam'

## Warning: Expecting logical in JB4862 / R4862C262: got 'Female'

## Warning: Expecting logical in JF4862 / R4862C266: got 'Saluwa'

## Warning: Expecting logical in JI4862 / R4862C269: got 'No'

## Warning: Expecting logical in JJ4862 / R4862C270: got 'Female'

## Warning: Expecting logical in JN4862 / R4862C274: got 'Amina'

## Warning: Expecting logical in JR4862 / R4862C278: got 'Female'

## Warning: Expecting logical in DU4867 / R4867C125: got 'No'

## Warning: Expecting logical in AIW4995 / R4995C933: got 'Ew ewTown hospital
## Bulan gawk'

## Warning: Expecting logical in TX5015 / R5015C544: got 'Enter lock'

```

## Warning: Expecting numeric in ZW5055 / R5055C699: got a date

## Warning: Expecting logical in AAR5198 / R5198C720: got 'Dont when the service  
## was conducted'

## Warning: Expecting logical in DU5225 / R5225C125: got 'No'

## Warning: Expecting logical in ES5225 / R5225C149: got 'No'

## Warning: Expecting logical in GG5225 / R5225C189: got 'Yes'

## Warning: Expecting logical in G05225 / R5225C197: got 'No'

## Warning: Expecting logical in OR5225 / R5225C408: got 'Maryam'

## Warning: Expecting logical in OT5225 / R5225C410: got 'Female'

## Warning: Expecting logical in OX5225 / R5225C414: got 'Hajara'

## Warning: Expecting logical in OZ5225 / R5225C416: got 'Female'

## Warning: Expecting numeric in AF05256 / R5256C847: got a date

## Warning: Expecting logical in AGH5256 / R5256C866: got 'We did not go back  
## because we are asked to come back after six month'

## Warning: Expecting numeric in ZW5260 / R5260C699: got a date

## Warning: Expecting logical in ACJ5260 / R5260C764: got 'Nothing'

## Warning: Expecting logical in ACV5260 / R5260C776: got 'Nothing'

## Warning: Expecting logical in FY5311 / R5311C181: got 'No'

## Warning: Expecting logical in GT5311 / R5311C202: got 'Ummuhani'

## Warning: Expecting logical in GX5311 / R5311C206: got 'Female'

## Warning: Expecting logical in HB5311 / R5311C210: got 'Laure'

## Warning: Expecting logical in HE5311 / R5311C213: got 'No'

## Warning: Expecting logical in HF5311 / R5311C214: got 'Female'

## Warning: Expecting logical in HJ5311 / R5311C218: got 'Fati'

## Warning: Expecting logical in HN5311 / R5311C222: got 'Female'

## Warning: Expecting logical in HR5311 / R5311C226: got 'Maryam'

## Warning: Expecting logical in HV5311 / R5311C230: got 'Female'

## Warning: Expecting logical in HZ5311 / R5311C234: got 'Fatiey'

## Warning: Expecting logical in ID5311 / R5311C238: got 'Female'

## Warning: Expecting logical in IH5311 / R5311C242: got 'Isah'

## Warning: Expecting logical in IL5311 / R5311C246: got 'Male'

## Warning: Expecting logical in IP5311 / R5311C250: got 'Fatima'

## Warning: Expecting logical in IT5311 / R5311C254: got 'Female'

## Warning: Expecting logical in IX5311 / R5311C258: got 'Hafsat'

## Warning: Expecting logical in JB5311 / R5311C262: got 'Female'

## Warning: Expecting logical in JF5311 / R5311C266: got 'Muhammad'

## Warning: Expecting logical in JJ5311 / R5311C270: got 'Male'

## Warning: Expecting logical in JN5311 / R5311C274: got 'Aisha'

## Warning: Expecting logical in JR5311 / R5311C278: got 'Female'

## Warning: Expecting logical in JV5311 / R5311C282: got 'Aminu'

## Warning: Expecting logical in JY5311 / R5311C285: got 'No'

## Warning: Expecting logical in JZ5311 / R5311C286: got 'Male'

## Warning: Expecting logical in KD5311 / R5311C290: got 'Sa'adu'

## Warning: Expecting logical in KH5311 / R5311C294: got 'Male'

## Warning: Expecting logical in KL5311 / R5311C298: got 'Aisha'

## Warning: Expecting logical in KP5311 / R5311C302: got 'Female'

## Warning: Expecting logical in KT5311 / R5311C306: got 'Haruna'

## Warning: Expecting logical in KX5311 / R5311C310: got 'Male'

## Warning: Expecting logical in OR5311 / R5311C408: got 'Aisha'

## Warning: Expecting logical in OT5311 / R5311C410: got 'Female'

## Warning: Expecting logical in OX5311 / R5311C414: got 'Hadiza'

## Warning: Expecting logical in OZ5311 / R5311C416: got 'Female'

## Warning: Expecting logical in PD5311 / R5311C420: got 'Zainab'

## Warning: Expecting logical in PF5311 / R5311C422: got 'Female'

## Warning: Expecting logical in PJ5311 / R5311C426: got 'Aisha'

## Warning: Expecting logical in PL5311 / R5311C428: got 'Female'

## Warning: Expecting logical in PP5311 / R5311C432: got 'Hauwa'

## Warning: Expecting logical in PR5311 / R5311C434: got 'Female'

## Warning: Expecting logical in PV5311 / R5311C438: got 'Safiya'

## Warning: Expecting logical in PX5311 / R5311C440: got 'Female'

## Warning: Expecting logical in QB5311 / R5311C444: got 'Harira'

## Warning: Expecting logical in QD5311 / R5311C446: got 'Female'

## Warning: Expecting logical in QH5311 / R5311C450: got 'Liba'

## Warning: Expecting logical in QJ5311 / R5311C452: got 'Female'

## Warning: Expecting logical in QN5311 / R5311C456: got 'Aisha'

## Warning: Expecting logical in QP5311 / R5311C458: got 'Female'

## Warning: Expecting logical in QT5311 / R5311C462: got 'Halima'

## Warning: Expecting logical in QV5311 / R5311C464: got 'Female'

## Warning: Expecting logical in QZ5311 / R5311C468: got 'Hauwau'

## Warning: Expecting logical in RB5311 / R5311C470: got 'Female'

## Warning: Expecting logical in RF5311 / R5311C474: got 'Usaina'

## Warning: Expecting logical in RH5311 / R5311C476: got 'Female'

## Warning: Expecting logical in RL5311 / R5311C480: got 'Halima'

## Warning: Expecting logical in RN5311 / R5311C482: got 'Female'

## Warning: Expecting logical in RR5311 / R5311C486: got 'Faiza'

## Warning: Expecting logical in RT5311 / R5311C488: got 'Female'

## Warning: Expecting logical in RX5311 / R5311C492: got 'Maryam'

## Warning: Expecting logical in RZ5311 / R5311C494: got 'Female'

## Warning: Expecting numeric in AF05498 / R5498C847: got a date

## Warning: Expecting logical in FY5561 / R5561C181: got 'Yes'

## Warning: Expecting logical in OR5561 / R5561C408: got 'Addeyo'

## Warning: Expecting logical in OT5561 / R5561C410: got 'Female'

## Warning: Expecting logical in AIQ5616 / R5616C927: got 'Chemist'

## Warning: Expecting logical in ES6174 / R6174C149: got 'No'

## Warning: Expecting logical in ES6182 / R6182C149: got 'No'

## Warning: Expecting logical in DU6184 / R6184C125: got 'No'

## Warning: Expecting logical in GG6184 / R6184C189: got 'No'

## Warning: Expecting logical in FA6187 / R6187C157: got 'No'

## Warning: Expecting logical in DU6191 / R6191C125: got 'No'

## Warning: Expecting logical in DU6193 / R6193C125: got 'No'

## Warning: Expecting logical in ES6193 / R6193C149: got 'No'

## Warning: Expecting logical in TX6299 / R6299C544: got 'Mud walls with cement  
## plaster'

## Warning: Expecting numeric in AF06539 / R6539C847: got a date

## Warning: Expecting logical in DU6655 / R6655C125: got 'No'

## Warning: Expecting numeric in ZW6672 / R6672C699: got a date

## Warning: Expecting numeric in ZW6961 / R6961C699: got a date

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## Warning: Expecting logical in AAR6971 / R6971C720: got 'They didn't bring it to
## us'

## Warning: Expecting logical in ES7067 / R7067C149: got 'No'

## Warning: Expecting logical in FI7067 / R7067C165: got 'No'

## Warning: Expecting numeric in ZW7338 / R7338C699: got a date

## Warning: Expecting numeric in AAG7338 / R7338C709: got a date

## Warning: Expecting numeric in ZW7342 / R7342C699: got a date

## Warning: Expecting numeric in AAG7342 / R7342C709: got a date

## Warning: Expecting numeric in ZW7353 / R7353C699: got a date

## Warning: Expecting numeric in ZW7354 / R7354C699: got a date

## Warning: Expecting numeric in ZW7360 / R7360C699: got a date

## Warning: Expecting numeric in ZW7362 / R7362C699: got '1 2 3 4'

## Warning: Expecting logical in DU7460 / R7460C125: got 'No'

## Warning: Expecting logical in ES7460 / R7460C149: got 'Yes'

## Warning: Expecting numeric in ZW7653 / R7653C699: got a date

## Warning: Expecting logical in DU7958 / R7958C125: got 'No'

## Warning: Expecting numeric in ZW7959 / R7959C699: got a date

## Warning: Expecting numeric in ZW7982 / R7982C699: got a date

## Warning: Expecting numeric in ZW7991 / R7991C699: got a date

## Warning: Expecting numeric in ZW8009 / R8009C699: got '2 4 5 6 7'

## Warning: Expecting numeric in ZW8012 / R8012C699: got '1 2 3 5 6 7'

## Warning: Expecting numeric in AAG8012 / R8012C709: got a date
```

```
df<-clean_names(df)
```

**Selected Child age in months**

```

# Create the cleaned age in months variable
df <- df %>%
  mutate(
    child_age_months_cleaned = case_when(
      !is.na(selected_chi_monthe) & selected_chi_monthe >= 3 & selected_chi_monthe <= 59 ~ selected_chi_monthe,
      !is.na(selected_chi_monthe) & !is.na(selected_chi_age) & selected_chi_age >= 1 & selected_chi_age < 12 ~ selected_chi_age,
      !is.na(selected_chi_monthe) & selected_chi_monthe > 59 & !is.na(selected_chi_age) ~ selected_chi_age,
      is.na(selected_chi_age) & is.na(selected_chi_monthe) ~ 3,
      is.na(selected_chi_monthe) & selected_chi_age < 12 ~ selected_chi_age,
      selected_chi_monthe > 59 & selected_chi_age < 5 ~ selected_chi_age * 12,
      TRUE ~ selected_chi_monthe
    )
  )

df <- df %>%
  mutate(
    age_group = case_when(
      child_age_months_cleaned >= 6 & child_age_months_cleaned <= 11 ~ "6-11 months",
      child_age_months_cleaned >= 12 & child_age_months_cleaned <= 59 ~ "12-59 months",
      TRUE ~ NA_character_
    )
  )

```

## Wealth Analysis

```

df <- df %>%
  mutate(
    water_source_score = case_when(
      hh_watersource == "Piped water" ~ 3,
      hh_watersource == "Bottled water" ~ 5,
      hh_watersource == "Sachet water/pure water" ~ 4,
      hh_watersource == "Rainwater" ~ 0,
      hh_watersource == "Tanker truck" ~ 1,
      hh_watersource == "Cart with small tank" ~ 0,
      hh_watersource == "Dug well" ~ 0,
      hh_watersource == "Surface water (river/dam/lake/pond/stream/canal/irrigation channel)" ~ 0,
      hh_watersource == "Others" ~ 0,
      hh_watersource == "" | is.na(hh_watersource) ~ 0,
      hh_watersource == "Water from spring" ~ 0,
      TRUE ~ 0
    ),
    toilet_type_score = case_when(
      hh_toilet_type == "FLUSH OR POUR FLUSH TOILET" ~ 3,
      hh_toilet_type == "PIT LATRINE" ~ 1,
      hh_toilet_type == "" | is.na(hh_toilet_type) ~ 0,
      TRUE ~ 0
    ),
    electricity_score = ifelse(hh_appliance_electricity == "Yes", 1, 0),
    refrigerator_score = ifelse(hh_appliance_refrigerator == "Yes", 1, 0),
    radio_score = ifelse(hh_appliance_radio == "Yes", 1, 0),
    TV_score = ifelse(hh_appliance_television == "Yes", 1, 0),
  )

```

```

cable_TV_score = ifelse(hh_appliance_cable_tv == "Yes", 1, 0),
AC_score = ifelse(hh_appliance_air_conditioner == "Yes", 1, 0),
computer_score = ifelse(hh_appliance_computer == "Yes", 1, 0),
fan_score = ifelse(hh_appliance_fan == "Yes", 1, 0),
non_appliance_score = ifelse(hh_appliance_none == "Yes", 1, 0),
iron_score = ifelse(hh_appliance_electronic_iron == "Yes", 1, 0),
generating_set_score = ifelse(hh_appliance_generating_set == "Yes", 1, 0),
mobile_Phone_score = ifelse(hh_appliance_mobile_telephone == "Yes", 1, 0),
non_mobile_phone_score = ifelse(hh_appliance_non_mobile_telephone == "Yes", 1, 0),
floor_type_score = case_when(
  hh_floor_type == "FINISHED FLOOR" ~ 3,
  hh_floor_type == "NATURAL FLOOR" ~ 0,
  TRUE ~ 0
),
fuel_source_score = case_when(
  hh_fuel_source == "ELECTRICITY" ~ 5,
  hh_fuel_source == "AGRICULTURAL CROP" ~ 0,
  hh_fuel_source == "ANIMAL DUNG" ~ 0,
  hh_fuel_source == "BIOGAS" ~ 3,
  hh_fuel_source == "CHARCOAL" ~ 2,
  hh_fuel_source == "COAL, LIGNITE" ~ 2,
  hh_fuel_source == "LIQUID PROPANE GAS/CYLINDER" ~ 4,
  hh_fuel_source == "NATURAL GAS" ~ 4,
  hh_fuel_source == "STRAW/SHRUBS/GRASS/SAWDUST" ~ 1,
  hh_fuel_source == "WOOD" ~ 1,
  hh_fuel_source == "" | is.na(hh_fuel_source) ~ 0,
  TRUE ~ 0
)
)
)

```

```
library(dplyr)
```

```
# Create new binary status variables
```

```
df <- df %>%
```

```
  mutate(
```

```
    # 1 = received VAS, 0 = did not
```

```
    status_coverage_VAS = ifelse(tolower(did_selected_chi_name_received_vitamin_a_dose_within_the_last_
```

```
    # MUAC screening
```

```
    status_muac = ifelse(tolower(did_selected_chi_name_received_a_muac_screening_during_the_last_mnchw_
```

```
    # Deworming
```

```
    status_deworming = ifelse(tolower(did_selected_chi_name_receive_a_deworming_tablet_during_the_last_
```

```
    # Immunization
```

```
    status_immunization = ifelse(tolower(question_did_selected_chi_name_receive_any_vaccine_during_the_
```

```
    # Malaria screening or treatment
```

```
    status_malaria_screening = ifelse(tolower(is_malaria_screening_and_treatment_services_that_you_can_
```

```
    # Treatment flag (same as VAS for causal analysis)
```

```
    treatment = status_coverage_VAS
```

```
)
```



## Define Treatment and Control Groups

```
# Load required library
library(dplyr)

# Create a treatment group variable
df <- df %>%
  mutate(
    group_VAS = case_when(
      did_selected_chi_name_received_vitamin_a_dose_within_the_last_6_months_from_any_source == "Yes" ~
      did_selected_chi_name_received_vitamin_a_dose_within_the_last_6_months_from_any_source == "No" ~
      TRUE ~ NA_character_
    )
  )

# Check distribution of groups
table(df$group_VAS, useNA = "ifany")

##
##   Control Treatment
##      4903      3161
```

### 3. Check for Baseline Differences (Covariates)

```
library(dplyr)
library(janitor)

# Categorical covariates to check
cat_vars <- c("selected_chi_sex", "caregiver_edu", "caregiver_employment", "hhh_employment", "lga", "we")

# Loop over categorical variables and run chi-square tests
for (var in cat_vars) {
  cat("\n--- Baseline difference by", var, "---\n")
  chisq_tbl <- table(df[[var]], df$group_VAS)
  print(chisq.test(chisq_tbl))
}

##
## --- Baseline difference by selected_chi_sex ---
##
##   Pearson's Chi-squared test with Yates' continuity correction
##
## data:  chisq_tbl
## X-squared = 1.3595, df = 1, p-value = 0.2436
##
## --- Baseline difference by caregiver_edu ---
##
##   Pearson's Chi-squared test with Yates' continuity correction
```

```
##
## data:  chisq_tbl
## X-squared = 328.9, df = 1, p-value < 2.2e-16
##
##
## --- Baseline difference by caregiver_employment ---
##
## Pearson's Chi-squared test
##
## data:  chisq_tbl
## X-squared = 90.132, df = 2, p-value < 2.2e-16
##
##
## --- Baseline difference by hhh_employment ---
##
## Pearson's Chi-squared test
##
## data:  chisq_tbl
## X-squared = 69.37, df = 2, p-value = 8.641e-16
##
##
## --- Baseline difference by lga ---
##
## Pearson's Chi-squared test
##
## data:  chisq_tbl
## X-squared = 630.91, df = 19, p-value < 2.2e-16
##
##
## --- Baseline difference by wealth_quintile_label ---
##
## Pearson's Chi-squared test
##
## data:  chisq_tbl
## X-squared = 95.778, df = 4, p-value < 2.2e-16
```

```
library(dplyr)

# Define covariates to test
covariates <- c(
  "selected_chi_sex", "age_group", "lga", "hhh_employment",
  "hhh_occupation", "caregiver_edu", "caregiver_employment", "wealth_quintile_label"
)

# Loop over each covariate and perform chi-square test
for (var in covariates) {
  cat("\n--- Baseline difference by", var, "---\n")

  temp_df <- df %>%
    filter(!is.na(group_VAS) & !is.na(.data[[var]])) %>%
    select(group_VAS, !!sym(var))

  freq_table <- table(temp_df[[var]], temp_df$group_VAS)
```

```

if (all(dim(freq_table) >= 2)) {
  print(freq_table)
  print(chisq.test(freq_table))
} else {
  cat("Skipped - Not enough valid data for", var, "\n")
}
}

```

```

##
## --- Baseline difference by selected_chi_sex ---
##
##           Control Treatment
##   Female      2458      1541
##   Male        2443      1617
##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data:  freq_table
## X-squared = 1.3595, df = 1, p-value = 0.2436
##
##
## --- Baseline difference by age_group ---
##
##           Control Treatment
## 12-59 months   3877      2605
## 6-11 months    546       295
##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data:  freq_table
## X-squared = 7.9175, df = 1, p-value = 0.004896
##
##
## --- Baseline difference by lga ---
##
##           Control Treatment
## Alkaleri       288       211
## Bauchi         246       256
## Bogoro         178       147
## DAMBAM         249       149
## Darazo         139       279
## Dass           141       184
## Gamawa         394        55
## Ganjuwa        234       166
## Giade          151       174
## Itas/Gadau     215       185
## Jama'are       236        89
## Katagum        409        92
## Kirfi          227        96
## Misau          211       189
## Ningi          252       148
## Shira          366       108
## Tafawa-Balewa  243       157

```

```

##      Toro            197      228
##      Warji           208      117
##      Zaki            319      131
##
##      Pearson's Chi-squared test
##
## data:  freq_table
## X-squared = 630.91, df = 19, p-value < 2.2e-16
##
##
## --- Baseline difference by hhh_employment ---
##
##              Control Treatment
##      Employed      510      530
##      Self-employed 3731     2229
##      Unemployed   662      402
##
##      Pearson's Chi-squared test
##
## data:  freq_table
## X-squared = 69.37, df = 2, p-value = 8.641e-16
##
##
## --- Baseline difference by hhh_occupation ---
##
##              Control Treatment
##      Cattle rearing   315      103
##      Civil Servant    330      339
##      Farming          1977     1333
##      Fishing           44       15
##      Others           473      285
##      Technician       163      107
##      Trading          939      577
##
##      Pearson's Chi-squared test
##
## data:  freq_table
## X-squared = 81.783, df = 6, p-value = 1.529e-15
##
##
## --- Baseline difference by caregiver_edu ---
##
##              Control Treatment
##      No      3399      1554
##      Yes     1504      1607
##
##      Pearson's Chi-squared test with Yates' continuity correction
##
## data:  freq_table
## X-squared = 328.9, df = 1, p-value < 2.2e-16
##
##
## --- Baseline difference by caregiver_employment ---
##

```

```
##           Control Treatment
##   Employed           95      169
##   Self-employed    1815    1281
##   Unemployed      2993    1711
##
##   Pearson's Chi-squared test
##
## data:  freq_table
## X-squared = 90.132, df = 2, p-value < 2.2e-16
##
##
## --- Baseline difference by wealth_quintile_label ---
##
##           Control Treatment
##   Poorest      1100      513
##   Poor         949      664
##   Middle      1057      556
##   Rich         933      680
##   Richest      864      748
##
##   Pearson's Chi-squared test
##
## data:  freq_table
## X-squared = 95.778, df = 4, p-value < 2.2e-16
```

## Estimate Average Treatment Effect (ATE)

```
# Effect of VAS treatment on MUAC screening
model_coverage_VAS <- glm(status_coverage_VAS ~ group_VAS + age_group + selected_chi_sex +
  caregiver_edu + caregiver_employment + hhh_employment +
  hhh_occupation + wealth_quintile_label + lga,
  data = df, family = binomial)

## Warning: glm.fit: algorithm did not converge

model_muac <- glm(status_muac ~ group_VAS + age_group + selected_chi_sex +
  caregiver_edu + caregiver_employment + hhh_employment +
  hhh_occupation + wealth_quintile_label + lga,
  data = df, family = binomial)

model_deworming <- glm(status_deworming ~ group_VAS + age_group + selected_chi_sex +
  caregiver_edu + caregiver_employment + hhh_employment +
  hhh_occupation + wealth_quintile_label + lga,
  data = df, family = binomial)

model_immunization <- glm(status_immunization ~ group_VAS + age_group + selected_chi_sex +
  caregiver_edu + caregiver_employment + hhh_employment +
  hhh_occupation + wealth_quintile_label + lga,
  data = df, family = binomial)

model_malaria_screenin <- glm(status_malaria_screening ~ group_VAS + age_group + selected_chi_sex +
```

```

        caregiver_edu + caregiver_employment + hhh_employment +
        hhh_occupation + wealth_quintile_label + lga,
        data = df, family = binomial)

summary(model_coverage_VAS)

##
## Call:
## glm(formula = status_coverage_VAS ~ group_VAS + age_group + selected_chi_sex +
##      caregiver_edu + caregiver_employment + hhh_employment + hhh_occupation +
##      wealth_quintile_label + lga, family = binomial, data = df)
##
## Coefficients:
##
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      -2.657e+01  4.101e+04  -0.001    0.999
## group_VASTreatment    5.313e+01  9.781e+03   0.005    0.996
## age_group6-11 months  -3.848e-11  1.441e+04   0.000    1.000
## selected_chi_sexMale    5.164e-12  8.940e+03   0.000    1.000
## caregiver_eduYes      -1.443e-10  1.120e+04   0.000    1.000
## caregiver_employmentSelf-employed -1.531e-09  2.755e+04   0.000    1.000
## caregiver_employmentUnemployed -1.532e-09  2.751e+04   0.000    1.000
## hhh_employmentSelf-employed    8.510e-10  1.895e+04   0.000    1.000
## hhh_occupationCivil Servant    9.421e-10  2.923e+04   0.000    1.000
## hhh_occupationFarming    2.202e-11  1.991e+04   0.000    1.000
## hhh_occupationFishing    1.610e-11  5.252e+04   0.000    1.000
## hhh_occupationOthers   -9.453e-11  2.352e+04   0.000    1.000
## hhh_occupationTechnician -6.398e-11  2.957e+04   0.000    1.000
## hhh_occupationTrading    1.714e-11  2.134e+04   0.000    1.000
## wealth_quintile_labelPoor   -8.779e-11  1.507e+04   0.000    1.000
## wealth_quintile_labelMiddle -4.078e-11  1.506e+04   0.000    1.000
## wealth_quintile_labelRich   -5.081e-11  1.532e+04   0.000    1.000
## wealth_quintile_labelRichest  9.416e-11  1.658e+04   0.000    1.000
## lgaBauchi    6.574e-10  2.924e+04   0.000    1.000
## lgaBogoro   -1.076e-11  3.091e+04   0.000    1.000
## lgaDAMBAM   -8.431e-11  2.965e+04   0.000    1.000
## lgaDarazo  -6.044e-10  2.787e+04   0.000    1.000
## lgaDass    -9.804e-11  2.961e+04   0.000    1.000
## lgaGamawa  -3.060e-12  2.760e+04   0.000    1.000
## lgaGanjuwa -8.170e-11  2.919e+04   0.000    1.000
## lgaGiade    3.485e-10  2.957e+04   0.000    1.000
## lgaItas/Gadabu  3.415e-10  2.816e+04   0.000    1.000
## lgaJama'are -6.858e-11  3.070e+04   0.000    1.000
## lgaKatagum  -3.670e-11  2.753e+04   0.000    1.000
## lgaKirfi   -2.521e-11  2.923e+04   0.000    1.000
## lgaMisau   -6.594e-11  2.776e+04   0.000    1.000
## lgaNingi   -1.200e-10  3.275e+04   0.000    1.000
## lgaShira   -8.532e-12  2.721e+04   0.000    1.000
## lgaTafawa-Balewa  8.304e-11  3.066e+04   0.000    1.000
## lgaToro    -3.084e-10  2.795e+04   0.000    1.000
## lgaWarji   -7.996e-11  2.955e+04   0.000    1.000
## lgaZaki    -2.932e-12  2.762e+04   0.000    1.000
##
## (Dispersion parameter for binomial family taken to be 1)

```

```
##
## Null deviance: 8.5947e+03 on 6382 degrees of freedom
## Residual deviance: 3.7031e-08 on 6346 degrees of freedom
## (1681 observations deleted due to missingness)
## AIC: 74
##
## Number of Fisher Scoring iterations: 25
```

```
summary(model_muac)
```

```
##
## Call:
## glm(formula = status_muac ~ group_VAS + age_group + selected_chi_sex +
##      caregiver_edu + caregiver_employment + hhh_employment + hhh_occupation +
##      wealth_quintile_label + lga, family = binomial, data = df)
##
## Coefficients:
##
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -2.4887762 0.3481287 -7.149 8.74e-13 ***
## group_VASTreatment 2.8504223 0.0911706 31.265 < 2e-16 ***
## age_group6-11 months -0.7702539 0.1345518 -5.725 1.04e-08 ***
## selected_chi_sexMale -0.1627459 0.0750279 -2.169 0.030072 *
## caregiver_eduYes 0.4463911 0.0918214 4.862 1.16e-06 ***
## caregiver_employmentSelf-employed -1.0933529 0.2088981 -5.234 1.66e-07 ***
## caregiver_employmentUnemployed -1.0512013 0.2073991 -5.068 4.01e-07 ***
## hhh_employmentSelf-employed -0.2720271 0.1519409 -1.790 0.073398 .
## hhh_occupationCivil Servant -0.0296341 0.2542117 -0.117 0.907199
## hhh_occupationFarming 0.2772508 0.1922089 1.442 0.149177
## hhh_occupationFishing 0.2555353 0.5094712 0.502 0.615970
## hhh_occupationOthers -0.1293428 0.2223364 -0.582 0.560739
## hhh_occupationTechnician -0.3103013 0.2715811 -1.143 0.253216
## hhh_occupationTrading -0.0007319 0.2037173 -0.004 0.997133
## wealth_quintile_labelPoor 0.9990281 0.1335316 7.482 7.34e-14 ***
## wealth_quintile_labelMiddle 0.4504100 0.1400268 3.217 0.001297 **
## wealth_quintile_labelRich 0.8049295 0.1367023 5.888 3.90e-09 ***
## wealth_quintile_labelRichest 0.4788058 0.1457548 3.285 0.001020 **
## lgaBauchi 1.1056852 0.2324187 4.757 1.96e-06 ***
## lgaBogoro -0.4740980 0.2523848 -1.878 0.060317 .
## lgaDAMBAM 0.8475533 0.2328017 3.641 0.000272 ***
## lgaDarazo 1.0701448 0.2123577 5.039 4.67e-07 ***
## lgaDass -0.2600177 0.2317144 -1.122 0.261800
## lgaGamawa -0.7471020 0.2961569 -2.523 0.011647 *
## lgaGanjuwa -0.3031135 0.2436960 -1.244 0.213566
## lgaGiade -0.2154451 0.2362916 -0.912 0.361887
## lgaItas/Gadua -1.1440154 0.2537952 -4.508 6.56e-06 ***
## lgaJama'are -0.2846598 0.2719679 -1.047 0.295253
## lgaKatagum -0.7057456 0.2741519 -2.574 0.010045 *
## lgaKirfi 1.3771340 0.2329438 5.912 3.38e-09 ***
## lgaMisau 0.3622305 0.2195635 1.650 0.098989 .
## lgaNingi -0.3416495 0.2741998 -1.246 0.212769
## lgaShira -0.2049584 0.2449830 -0.837 0.402804
## lgaTafawa-Balewa -0.2888453 0.2740067 -1.054 0.291812
## lgaToro 0.0381619 0.2257686 0.169 0.865772
## lgaWarji 0.5527053 0.2399591 2.303 0.021260 *
```

```
## lgaZaki          0.0964185  0.2346278  0.411 0.681115
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
## Null deviance: 6903.5  on 6382  degrees of freedom
## Residual deviance: 4537.2  on 6346  degrees of freedom
## (1681 observations deleted due to missingness)
## AIC: 4611.2
##
## Number of Fisher Scoring iterations: 6
```

```
summary(model_deworming)
```

```
##
## Call:
## glm(formula = status_deworming ~ group_VAS + age_group + selected_chi_sex +
##   caregiver_edu + caregiver_employment + hhh_employment + hhh_occupation +
##   wealth_quintile_label + lga, family = binomial, data = df)
##
## Coefficients:
##
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -1.79853 0.31640 -5.684 1.31e-08 ***
## group_VASTreatment 2.66481 0.07319 36.411 < 2e-16 ***
## age_group6-11 months -0.62557 0.11515 -5.433 5.55e-08 ***
## selected_chi_sexMale -0.04317 0.06741 -0.640 0.521914
## caregiver_eduYes 0.52985 0.08282 6.398 1.58e-10 ***
## caregiver_employmentSelf-employed -1.03353 0.20268 -5.099 3.41e-07 ***
## caregiver_employmentUnemployed -1.12735 0.20163 -5.591 2.25e-08 ***
## hhh_employmentSelf-employed -0.04383 0.13963 -0.314 0.753593
## hhh_occupationCivil Servant 0.26061 0.22878 1.139 0.254665
## hhh_occupationFarming 0.42304 0.16833 2.513 0.011965 *
## hhh_occupationFishing 0.00486 0.43022 0.011 0.990987
## hhh_occupationOthers -0.12982 0.19548 -0.664 0.506633
## hhh_occupationTechnician -0.14092 0.24114 -0.584 0.558946
## hhh_occupationTrading 0.19971 0.17831 1.120 0.262697
## wealth_quintile_labelPoor 0.74656 0.11610 6.430 1.28e-10 ***
## wealth_quintile_labelMiddle 0.25718 0.11970 2.149 0.031665 *
## wealth_quintile_labelRich 0.52945 0.11916 4.443 8.86e-06 ***
## wealth_quintile_labelRichest 0.37379 0.12756 2.930 0.003386 **
## lgaBauchi 0.01655 0.21668 0.076 0.939115
## lgaBogoro 0.02806 0.22573 0.124 0.901088
## lgaDAMBAM 0.44257 0.21615 2.048 0.040608 *
## lgaDarazo 0.68235 0.20315 3.359 0.000783 ***
## lgaDass -0.63346 0.21478 -2.949 0.003185 **
## lgaGamawa 0.48992 0.20936 2.340 0.019281 *
## lgaGanjuwa 0.41125 0.21656 1.899 0.057564 .
## lgaGiade -0.14763 0.21503 -0.687 0.492362
## lgaItas/Gadua 0.16034 0.20640 0.777 0.437266
## lgaJama'are -0.74017 0.24835 -2.980 0.002879 **
## lgaKatagum -0.77369 0.23450 -3.299 0.000969 ***
## lgaKirfi 1.05824 0.21145 5.005 5.60e-07 ***
## lgaMisau 0.33349 0.20258 1.646 0.099717 .
```



```
## lgaNingi -0.58724 0.25136 -2.336 0.019479 *
## lgaShira -0.31403 0.21510 -1.460 0.144306
## lgaTafawa-Balewa -0.52944 0.24343 -2.175 0.029639 *
## lgaToro -0.37806 0.20843 -1.814 0.069699 .
## lgaWarji 0.22682 0.22009 1.031 0.302724
## lgaZaki -0.27971 0.21391 -1.308 0.190993
```

```
## ---
```

```
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
```

```
## (Dispersion parameter for binomial family taken to be 1)
```

```
##
```

```
## Null deviance: 8063.9 on 6382 degrees of freedom
```

```
## Residual deviance: 5568.4 on 6346 degrees of freedom
```

```
## (1681 observations deleted due to missingness)
```

```
## AIC: 5642.4
```

```
##
```

```
## Number of Fisher Scoring iterations: 5
```

```
summary(model_immunization)
```

```
##
```

```
## Call:
```

```
## glm(formula = status_immunization ~ group_VAS + age_group + selected_chi_sex +
```

```
## caregiver_edu + caregiver_employment + hhh_employment + hhh_occupation +
```

```
## wealth_quintile_label + lga, family = binomial, data = df)
```

```
##
```

```
## Coefficients:
```

	Estimate	Std. Error	z value	Pr(> z )	
## (Intercept)	3.61173	1.33304	2.709	0.006741	**
## group_VASTreatment	2.16755	0.30357	7.140	9.32e-13	***
## age_group6-11 months	-0.32335	0.32305	-1.001	0.316864	
## selected_chi_sexMale	-0.12827	0.24953	-0.514	0.607219	
## caregiver_eduYes	0.96867	0.30480	3.178	0.001483	**
## caregiver_employmentSelf-employed	-1.59858	0.78829	-2.028	0.042570	*
## caregiver_employmentUnemployed	-2.09971	0.78929	-2.660	0.007808	**
## hhh_employmentSelf-employed	-0.20236	0.55256	-0.366	0.714194	
## hhh_occupationCivil Servant	-1.69755	0.82433	-2.059	0.039465	*
## hhh_occupationFarming	-0.10473	0.59747	-0.175	0.860848	
## hhh_occupationFishing	-1.20046	1.49194	-0.805	0.421035	
## hhh_occupationOthers	-0.55761	0.66779	-0.835	0.403711	
## hhh_occupationTechnician	-0.30430	0.98081	-0.310	0.756371	
## hhh_occupationTrading	-0.01751	0.63277	-0.028	0.977924	
## wealth_quintile_labelPoor	1.67999	0.55396	3.033	0.002424	**
## wealth_quintile_labelMiddle	0.99422	0.55539	1.790	0.073432	.
## wealth_quintile_labelRich	1.69988	0.55011	3.090	0.002001	**
## wealth_quintile_labelRichest	2.02756	0.57549	3.523	0.000426	***
## lgaBauchi	-5.20631	1.02311	-5.089	3.60e-07	***
## lgaBogoro	-4.56119	0.96885	-4.708	2.50e-06	***
## lgaDAMBAM	-1.87474	1.67848	-1.117	0.264024	
## lgaDarazo	-3.75203	0.97561	-3.846	0.000120	***
## lgaDass	-4.05973	0.99290	-4.089	4.34e-05	***
## lgaGamawa	-2.80297	0.99734	-2.810	0.004947	**
## lgaGanjuwa	-4.53806	0.94642	-4.795	1.63e-06	***
## lgaGiade	-4.59310	1.19977	-3.828	0.000129	***

```
## lgaItas/Gadabu -5.12120 1.15284 -4.442 8.90e-06 ***
## lgaJama'are -6.83079 1.46666 -4.657 3.20e-06 ***
## lgaKatagum 11.48053 875.73311 0.013 0.989540
## lgaKirfi -1.97068 1.46395 -1.346 0.178257
## lgaMisau -2.75947 1.26841 -2.176 0.029590 *
## lgaNingi -1.36070 1.37380 -0.990 0.321947
## lgaShira -2.84261 1.13142 -2.512 0.011990 *
## lgaTafawa-Balewa -2.43538 1.03828 -2.346 0.018997 *
## lgaToro -5.84739 0.96440 -6.063 1.33e-09 ***
## lgaWarji -1.22526 1.48022 -0.828 0.407812
## lgaZaki -2.74117 0.99092 -2.766 0.005670 **
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
## Null deviance: 679.32 on 519 degrees of freedom
## Residual deviance: 431.28 on 483 degrees of freedom
## (7544 observations deleted due to missingness)
## AIC: 505.28
##
## Number of Fisher Scoring iterations: 15
```

```
summary(model_malaria_screenin)
```

```
##
## Call:
## glm(formula = status_malaria_screening ~ group_VAS + age_group +
## selected_chi_sex + caregiver_edu + caregiver_employment +
## hhh_employment + hhh_occupation + wealth_quintile_label +
## lga, family = binomial, data = df)
##
## Coefficients:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.92985 0.48077 -1.934 0.053100 .
## group_VASTreatment 0.15409 0.12353 1.247 0.212274
## age_group6-11 months 0.10448 0.17182 0.608 0.543133
## selected_chi_sexMale -0.05120 0.10108 -0.507 0.612490
## caregiver_eduYes 0.46621 0.12788 3.646 0.000267 ***
## caregiver_employmentSelf-employed -0.51989 0.23832 -2.181 0.029147 *
## caregiver_employmentUnemployed -0.37334 0.23433 -1.593 0.111117
## hhh_employmentSelf-employed 0.07974 0.19999 0.399 0.690092
## hhh_occupationCivil Servant -0.20080 0.35081 -0.572 0.567070
## hhh_occupationFarming 0.20346 0.26885 0.757 0.449185
## hhh_occupationFishing -0.58575 0.68494 -0.855 0.392451
## hhh_occupationOthers -0.07782 0.31301 -0.249 0.803657
## hhh_occupationTechnician 0.09653 0.36478 0.265 0.791300
## hhh_occupationTrading -0.04073 0.28637 -0.142 0.886905
## wealth_quintile_labelPoor -0.13445 0.20049 -0.671 0.502472
## wealth_quintile_labelMiddle 0.09501 0.20742 0.458 0.646889
## wealth_quintile_labelRich -0.30147 0.20107 -1.499 0.133784
## wealth_quintile_labelRichest -0.10684 0.21479 -0.497 0.618909
## lgaBauchi -0.73975 0.37901 -1.952 0.050960 .
## lgaBogoro 1.51988 0.31366 4.846 1.26e-06 ***
```

```

## lgaDAMBAM          -1.27055      0.50644  -2.509 0.012114 *
## lgaDarazo          -0.84726      0.31849  -2.660 0.007809 **
## lgaDass            -0.89381      0.43046  -2.076 0.037858 *
## lgaGamawa          1.17345      0.34712   3.380 0.000724 ***
## lgaGanjuwa         0.84298      0.30933   2.725 0.006426 **
## lgaGiade           -1.12764      0.40564  -2.780 0.005438 **
## lgaItas/Gadau      1.97583      0.33684   5.866 4.47e-09 ***
## lgaJama'are        -0.08283      0.44921  -0.184 0.853702
## lgaKatagum         0.66451      0.37517   1.771 0.076521 .
## lgaKirfi           -0.32200      0.35751  -0.901 0.367772
## lgaMisau           -0.39670      0.34188  -1.160 0.245912
## lgaNingi           0.19144      0.35533   0.539 0.590042
## lgaShira           -0.23405      0.35643  -0.657 0.511408
## lgaTafawa-Balewa  -2.21485      0.77605  -2.854 0.004317 **
## lgaToro            0.95784      0.31614   3.030 0.002448 **
## lgaWarji           0.73182      0.33976   2.154 0.031247 *
## lgaZaki            -0.94776      0.41074  -2.307 0.021028 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##    Null deviance: 2839.0  on 2235  degrees of freedom
## Residual deviance: 2382.4  on 2199  degrees of freedom
##    (5828 observations deleted due to missingness)
## AIC: 2456.4
##
## Number of Fisher Scoring iterations: 5

```