Rural Urban dynamics (DTE Datathon)

Group 7

2023-09-26

Introduction

This analysis is intended for the DTE datathon, which aims to cultivate a data-driven, innovative, and collaborative environment for creatively addressing societal issues and producing actionable solutions.

```
library(tidyverse)
library(gridExtra)
library(readxl)
library(reshape2)
library(janitor)
library(ggthemes)

library(knitr)
# library(kableExtra)

df <- data.frame(
  Details = c("Time Frame","Deadline","Software/Tools"),
  values  = c("1 Week","28th September","R - studio")
)
df %>% kable(caption = "The rules of the datathon")
```

Table 1: The rules of the datathon

Details	values
Time Frame	1 Week
Deadline	28th September
Software/Tools	R - studio

> `The objective:` The objective of this challenge is to analyze open data sets in Kenya using real-world data. You are therefore to explore, visualize, and draw insights from the provided dataset to provide better insights to different stakeholders on how urbanization is impacting different aspects of Kenyan society. Participants should work in teams and are encouraged to utilize technologies such as big data, machine learning, and artificial Intelligence that train test, and evaluate multiple data sets to uncover innovative solutions.

```
colors <- c('#BC5308', '#FFECD1', '#C5CAB8', '#FF7D00', '#8AA79F', '#FFB569', '#15616D', '#001524')

df <- read_excel("Dataset/Dataset.xlsx")
```

```r
kenya <- df
kenya1 <- df
df %>% select(1:7) %>% head() %>% knitr::kable(caption = "A sample of the data")
```

Table 2: A sample of the data

COUNTY	County	Rural_ppn	Urban_ppn	Total Population	Urban/Total	Status
Baringo	Baringo	591474	75289	666763	0.1129172	Rural
Bomet	Bomet	847718	27971	875689	0.0319417	Rural
Bungoma	Bungoma	1480458	190112	1670570	0.1138007	Rural
Busia	Busia	779928	113753	893681	0.1272859	Rural
Elgeiyo-Marakwet	Elgeiyo-Marakwet	433901	20579	454480	0.0452803	Rural
Embu	Embu	532675	75924	608599	0.1247521	Rural

data

As per the rules, we sourced the data from KNBS on the following website: KNBS Data.

Additionally, we obtained supplementary data from the following website: Kenya County Fact Sheets Report (PDF).

The collected data encompasses a wide range of aspects of Kenyan life, including population, GDP, infrastructure, education, healthcare, and employment.

data sourcing and cleaning

The data collection process was primarily manual, and it followed the following general steps:

1. **Data Compilation:** We collaborated in Google Sheets to collect various data points simultaneously, gradually building up the dataset we needed.
2. **Data Cleaning:** We employed a manual query system to identify and address any anomalies or outliers in the dataset. This process involved thorough cross-checking to ensure data accuracy.
3. **Feature Engineering:** We created additional columns in the dataset, such as:
   - Total Population: $totalPopulation = femalePopulation + malePopulation$
   - Urban-Rural Classification: $urbanRural = \frac{urbanPopulation}{totalPopulation}$

   Based on the urban-rural classification, we categorized certain counties as either rural or urban. Counties were classified as fully urban if the urban population exceeded 40% of the total population.

Rural-Urban population dynamics

Rural-Urban health dynamics

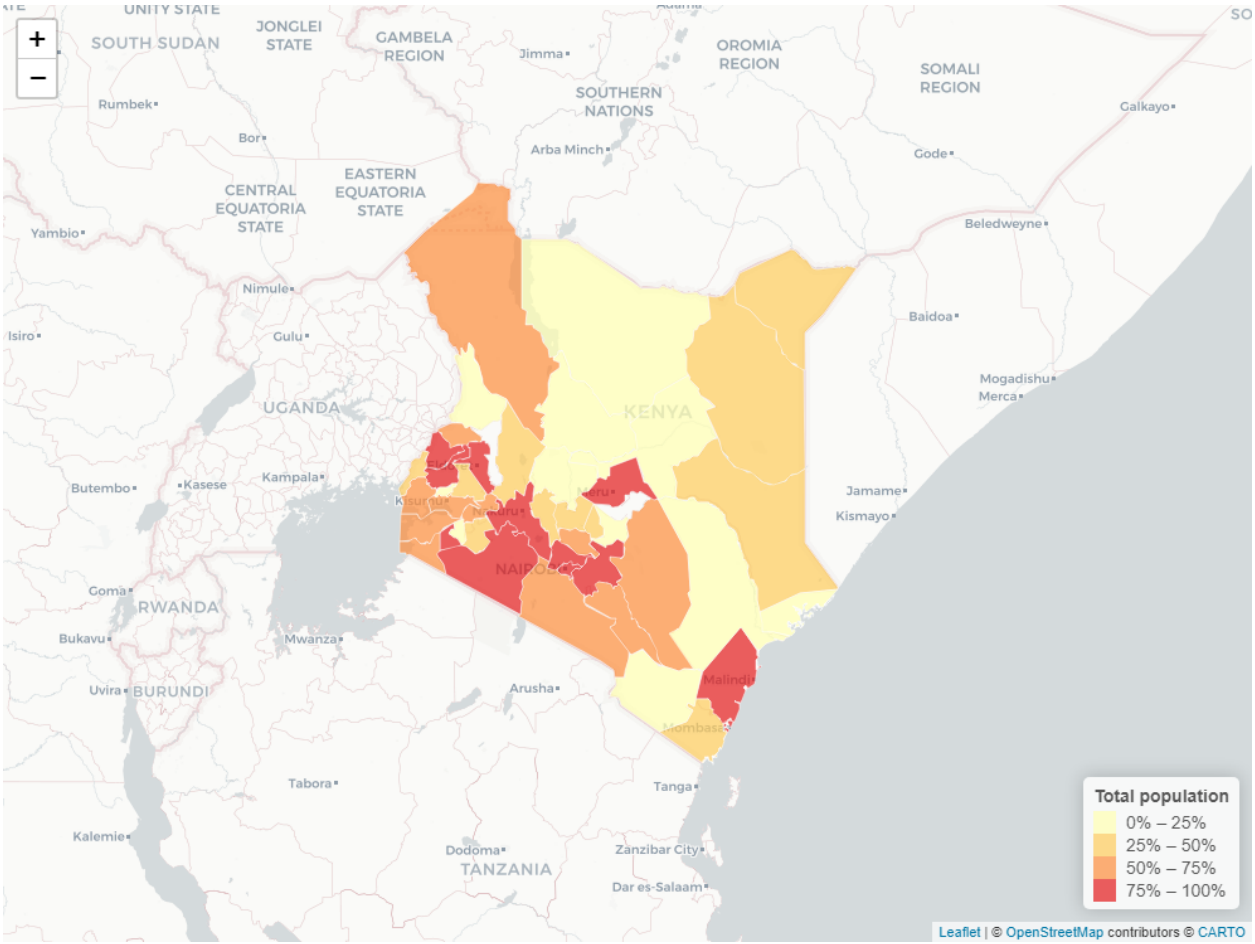
```r
library(leaflet)
library(sf)

# Load the shapefile
kenya_counties <- st_read("LYNN ANALYSIS/County.shp")
```

```
Reading layer ‘County’ from data source
  ‘D:\Aesops\DTE-Datathon\LYNN ANALYSIS\County.shp’ using driver ‘ESRI Shapefile’
Simple feature collection with 47 features and 8 fields
Geometry type: MULTIPOLYGON
Dimension:     XY
Bounding box:  xmin: 33.91182 ymin: -4.702271 xmax: 41.90626 ymax: 5.430648
Geodetic CRS:  WGS 84
```

```r
# Merge data by county
merged_data <- merge(kenya_counties, kenya, by.x = "COUNTY", by.y = "COUNTY")
```

```r
# Create a leaflet map
#install.packages("leaflet")
#remotes::install_github("rstudio/webshot2")
library(leaflet)
library(webshot2)
kenya_map <- leaflet(merged_data) %>%
  addProviderTiles("CartoDB.Positron") %>%
  addPolygons(
    fillColor = ~colorQuantile("YlOrRd", merged_data$`Total Population`)(merged_data$`Total Population`)
    fillOpacity = 0.7,
    color = "white",
    weight = 1,
    label = ~paste(merged_data$COUNTY, "<br>", "Total Population:", merged_data$`Total Population`, "pe
    highlight = highlightOptions(
      weight = 3,
      color = "#666",
      fillOpacity = 0.7,
      bringToFront = TRUE
    ),
    labelOptions = labelOptions(
      style = list("font-weight" = "normal", padding = "3px 8px"),
      textsize = "15px"
    )
  ) %>%
  addLegend(
    "bottomright",
    pal = colorQuantile("YlOrRd", merged_data$`Total Population`),
    values = ~merged_data$`Total Population`,
    title = "Total population",
    opacity = 0.7
  )

# Display the map
htmlwidgets::saveWidget(kenya_map, "kenya_map.html")
```

```
# Take a screenshot and save it as an image
webshot2::webshot("kenya_map.html", "kenya_map.png")
```



#Health Analysis

```
# Filter and summarize the data to count level 5/6 hospitals by county
level_5_6_hospitals <- kenya %>%
  filter(`Health_LV5/6` > 0)%>%
  select(COUNTY, `Health_LV5/6`)
  #group_by(COUNTY) %>%
  #summarise(Count_Level_5_6_Hospitals = sum(Health_LV5/6))

# Create a table using kable
#kable(level_5_6_hospitals, caption = "Count of Level 5/6 Hospitals by County")
```

```
# Load the required libraries
library(ggplot2)

# Filter the data to include only rural counties
kenya_rural <- kenya %>%
  filter(Status == "Rural") %>%
  arrange(Health_LV4)
```

```r
# Create the bar chart
fig1<- ggplot(kenya_rural, aes(x = reorder(COUNTY, -Health_LV4), y = Health_LV4, fill = "#BC5308")) +
  geom_bar(stat = "identity", show.legend = FALSE) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 4 Hospitals") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 4 Hospitals by Rural Counties") +
  coord_flip()+
  scale_fill_manual(values = colors)
```

```r
# Filter the data to include only rural counties
kenya_rural <- kenya %>%
  filter(Status == "Urban") %>%
  arrange(Health_LV4)

# Create the bar chart
fig2<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -Health_LV4), y = Health_LV4)) +
  geom_bar(stat = "identity", show.legend = FALSE,fill=colors[7]) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 4 Hospitals") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 4 Hospitals by Urban Counties") +
  coord_flip()+
  scale_fill_manual(values = colors)
```

```r
# Filter the data to include only rural counties
kenya_rural <- kenya %>%
  filter(Status == "Rural") %>%
  arrange(Health_LV3)

# Create the bar chart
fig3<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -Health_LV3), y = Health_LV3, fill = "#BC5308")) +
  geom_bar(stat = "identity", show.legend = FALSE) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 3 Hospitals") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 3 Hospitals by Rural Counties") +
  coord_flip()+
  scale_fill_manual(values = colors)
```

```r
# Filter the data to include only rural counties
kenya_rural <- kenya %>%
  filter(Status == "Urban") %>%
  arrange(Health_LV3)

# Create the bar chart
fig4<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -Health_LV3), y = Health_LV3)) +
  geom_bar(stat = "identity", show.legend = FALSE,fill=colors[7]) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 3 Hospitals") +
```

```
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 3 Hospitals by Urban Counties") +
  coord_flip()+
  scale_fill_manual(values = colors)
```

```
kenya_rural<-kenya%>%
  filter(Status=="Rural")%>%
  arrange(Health_LV2)

#create bar chart
fig5<-ggplot(kenya, aes(x = reorder(COUNTY, -Health_LV2), y = Health_LV2, fill = "#15616D")) +
  geom_bar(stat = "identity",show.legend = FALSE) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 2 Hospitals") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 2 Hospitals by Rural Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

```
kenya_rural<-kenya%>%
  filter(Status=="Urban")%>%
  arrange(Health_LV2)

#create bar chart
fig6<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -Health_LV2), y = Health_LV2)) +
  geom_bar(stat = "identity",show.legend = FALSE,fill=colors[7]) +
  theme_minimal() +
  labs(x = "County", y = "Number of Level 2 Hospitals") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Level 2 Hospitals by Urban Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

```
kenya_rural<-kenya%>%
  filter(Status=="Rural")%>%
  arrange(`Bed density per 10000 ppn`)

#create bar chart
fig7<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -`Bed density per 10000 ppn`), y = `Bed density per 1
                              fill="#15616D")) +
  geom_bar(stat = "identity",show.legend = FALSE) +
  theme_minimal() +
  labs(x = "County", y = "Bed density per 10000 ppn") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Bed density per 10000 ppn by Rural Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

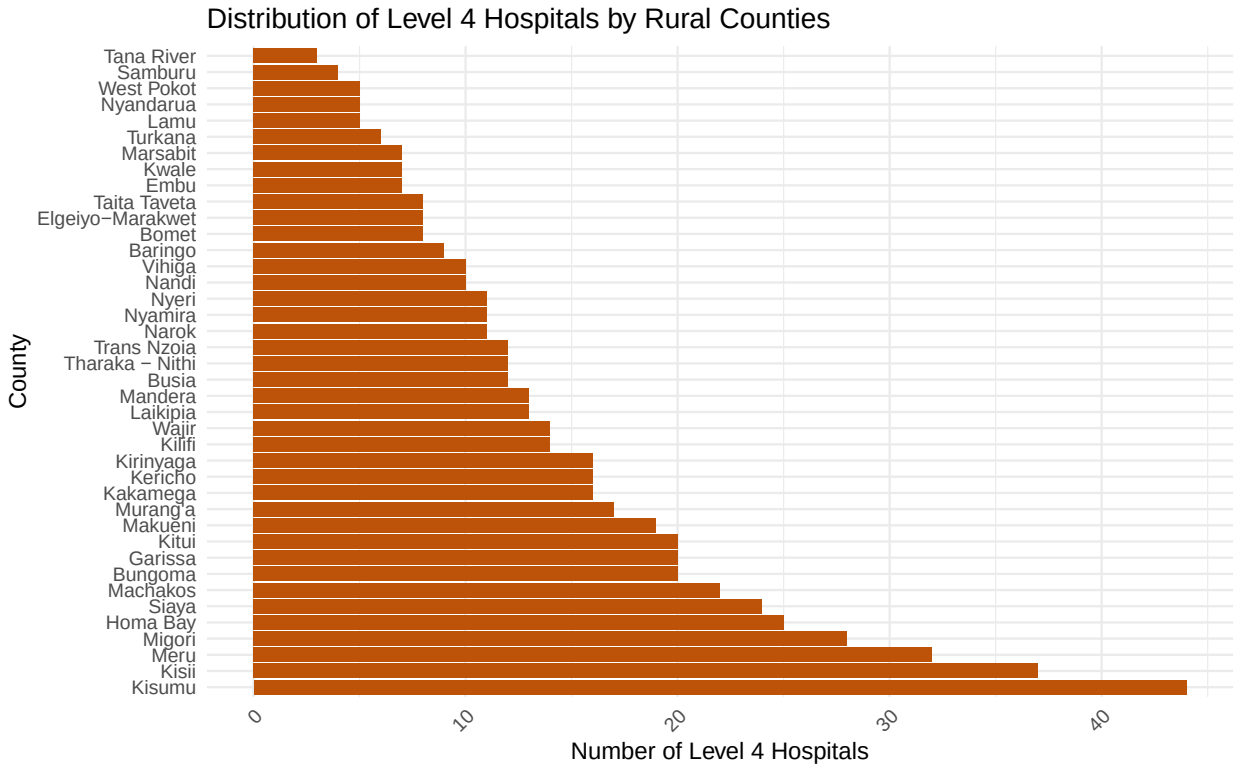
```
kenya_rural<-kenya%>%
  filter(Status=="Urban")%>%
  arrange(`Bed density per 10000 ppn`)

#create bar chart
fig8<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -`Bed density per 10000 ppn`), y = `Bed density per 1
  geom_bar(stat = "identity",show.legend = FALSE,fill=colors[7]) +
  theme_minimal() +
  labs(x = "County", y = "Bed density per 10000 ppn") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Bed density per 10000 ppn by Urban Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

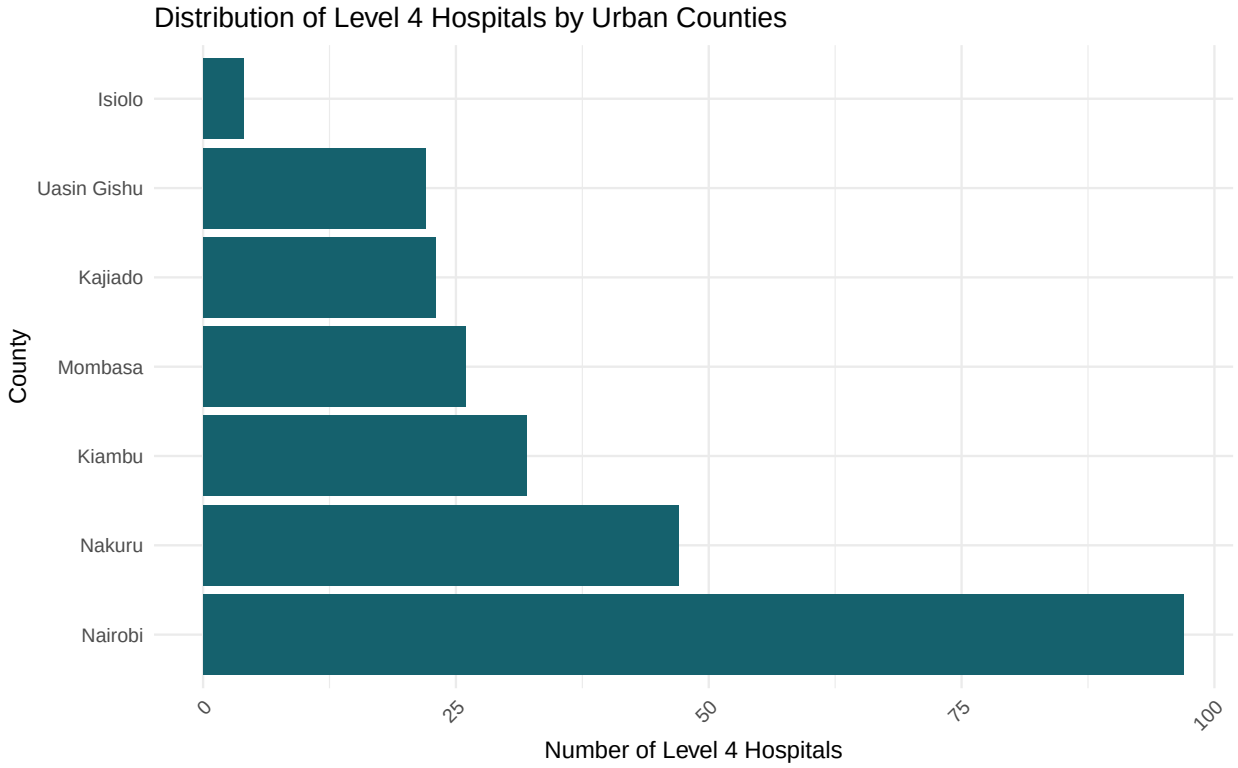
```
kenya_rural<-kenya%>%
  filter(Status=="Rural")%>%
  arrange(`Health worker per 10000 ppn`)

#create bar chart
fig9<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -`Health worker per 10000 ppn`), y = `Health worker p
                              fill="#15616D")) +
  geom_bar(stat = "identity",show.legend = FALSE) +
  theme_minimal() +
  labs(x = "County", y = "Health worker per 10000 ppn") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Health worker per 10000 ppn by Urban Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

```
kenya_rural<-kenya%>%
  filter(Status=="Urban")%>%
  arrange(`Health worker per 10000 ppn`)

#create bar chart
fig10<-ggplot(kenya_rural, aes(x = reorder(COUNTY, -`Health worker per 10000 ppn`), y = `Health worker
  geom_bar(stat = "identity",show.legend = FALSE,fill=colors[7]) +
  theme_minimal() +
  labs(x = "County", y = "Health worker per 10000 ppn") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_discrete(name = "County") +
  ggtitle("Distribution of Health worker per 10000 ppn by Urban Counties")+
  coord_flip()+
  scale_fill_manual(values = colors)
```

Bar charts showing Level 4 Hospital Distribution by counties

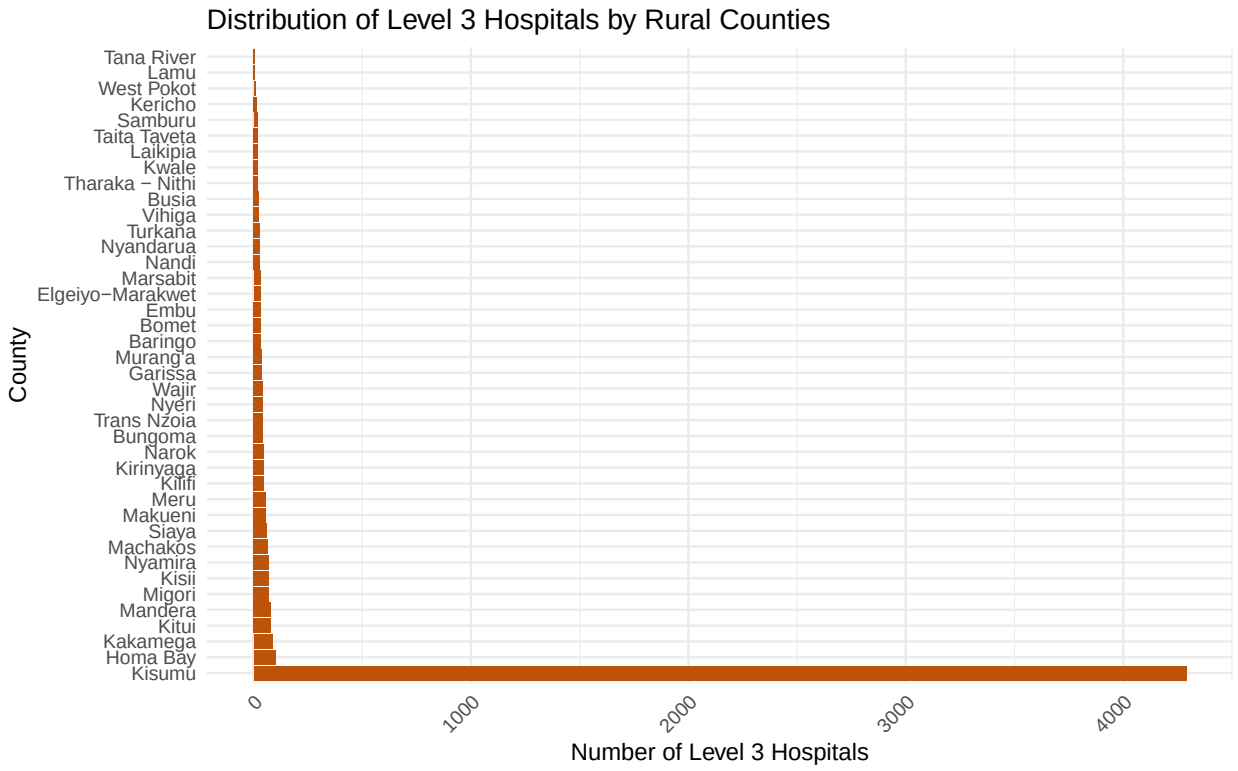
```
library(gridExtra)
grid.arrange(fig1,fig2,ncol=1)
```

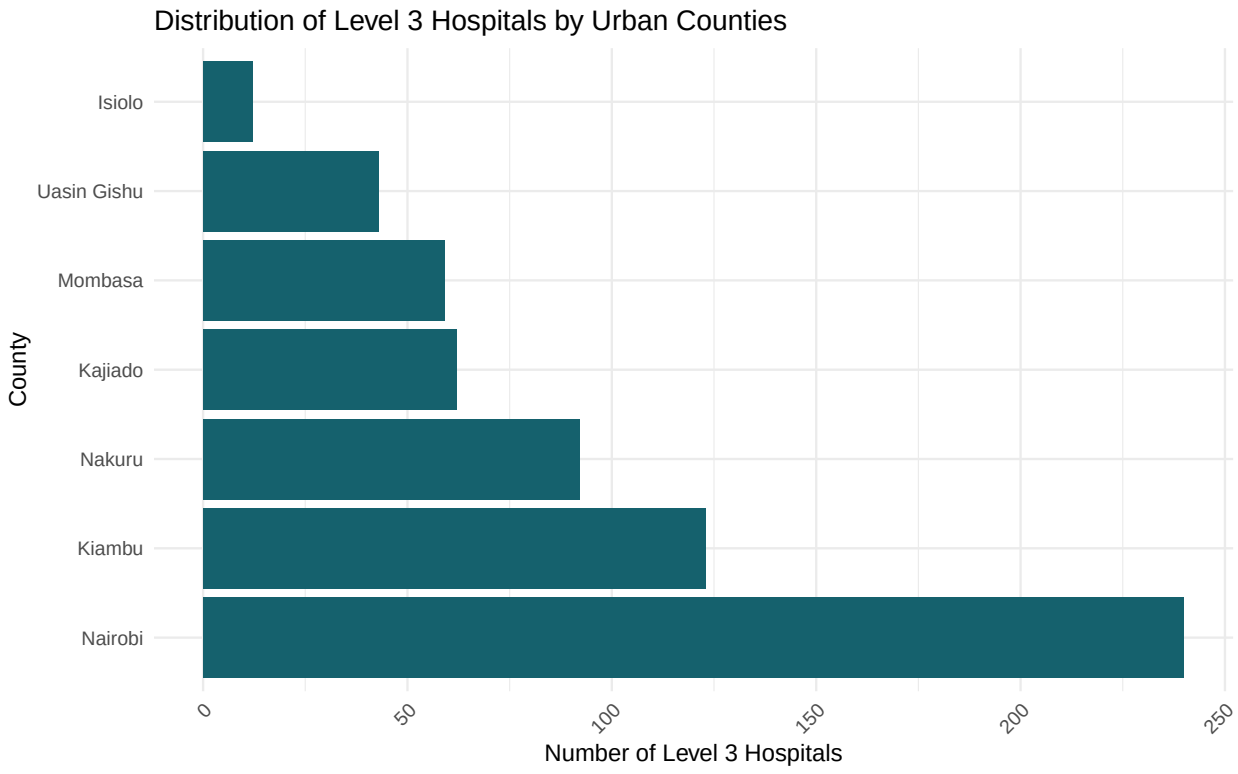

Distribution of Level 4 Hospitals by Rural Counties
Tana River
Samburu
West Pokot
Nyandarua
Lamu
Turkana
Marsabit
Kwale
Embu
Taita Taveta
Elgeiyo−Marakwet
Bomet
Baringo
Vihiga
Nandi
Nyeri
Nyamira
Narok
Trans Nzoia
Tharaka − Nithi
Busia
Mandera
Laikipia
Wajir
Kilifi
Kirinyaga
Kericho
Kakamega
Murang'a
Makueni
Kitui
Garissa
Bungoma
Machakos
Siaya
Homa Bay
Migori
Meru
Kisii
Kisumu
County
0
10
20
30
40
Number of Level 4 Hospitals


Distribution of Level 4 Hospitals by Urban Counties
Isiolo
Uasin Gishu
Kajiado
Mombasa
Kiambu
Nakuru
Nairobi
County
0
25
50
75
100
Number of Level 4 Hospitals

Bar charts showing Level 3 Hospital Distribution by counties

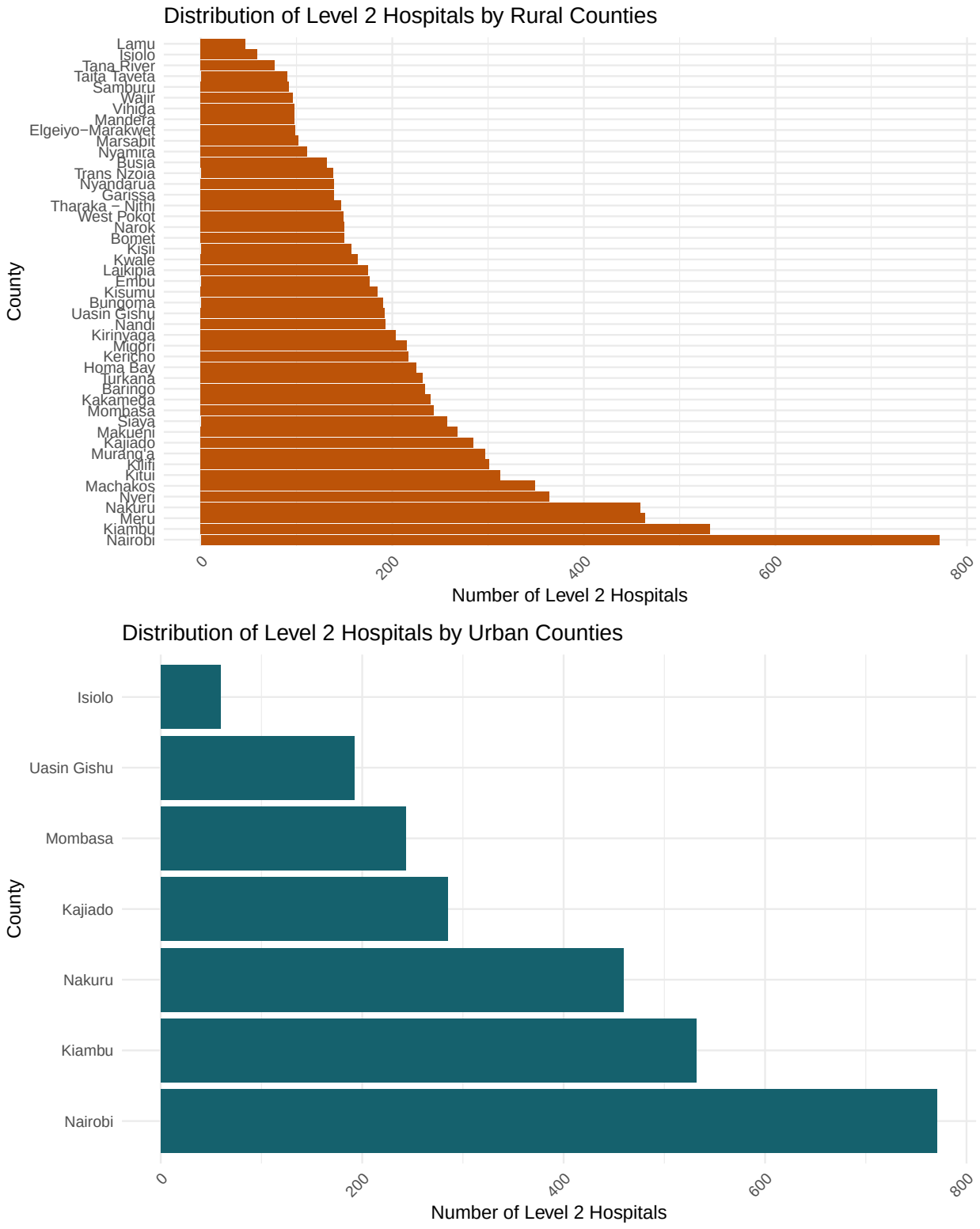
```
grid.arrange(fig3,fig4,ncol=1)
```





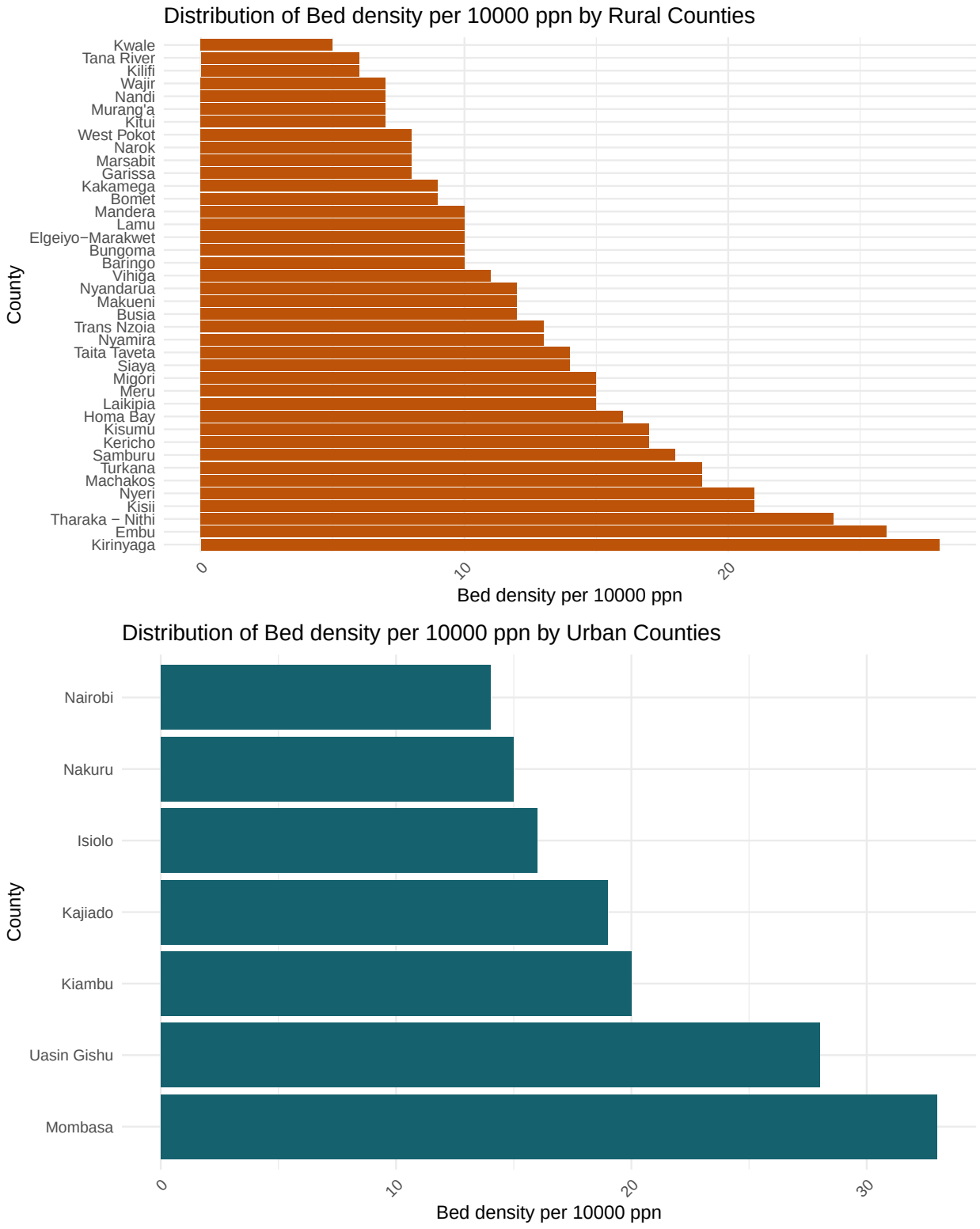
Bar charts showing Level 2 Hospital Distribution by counties

```
grid.arrange(fig5,fig6,ncol=1)
```



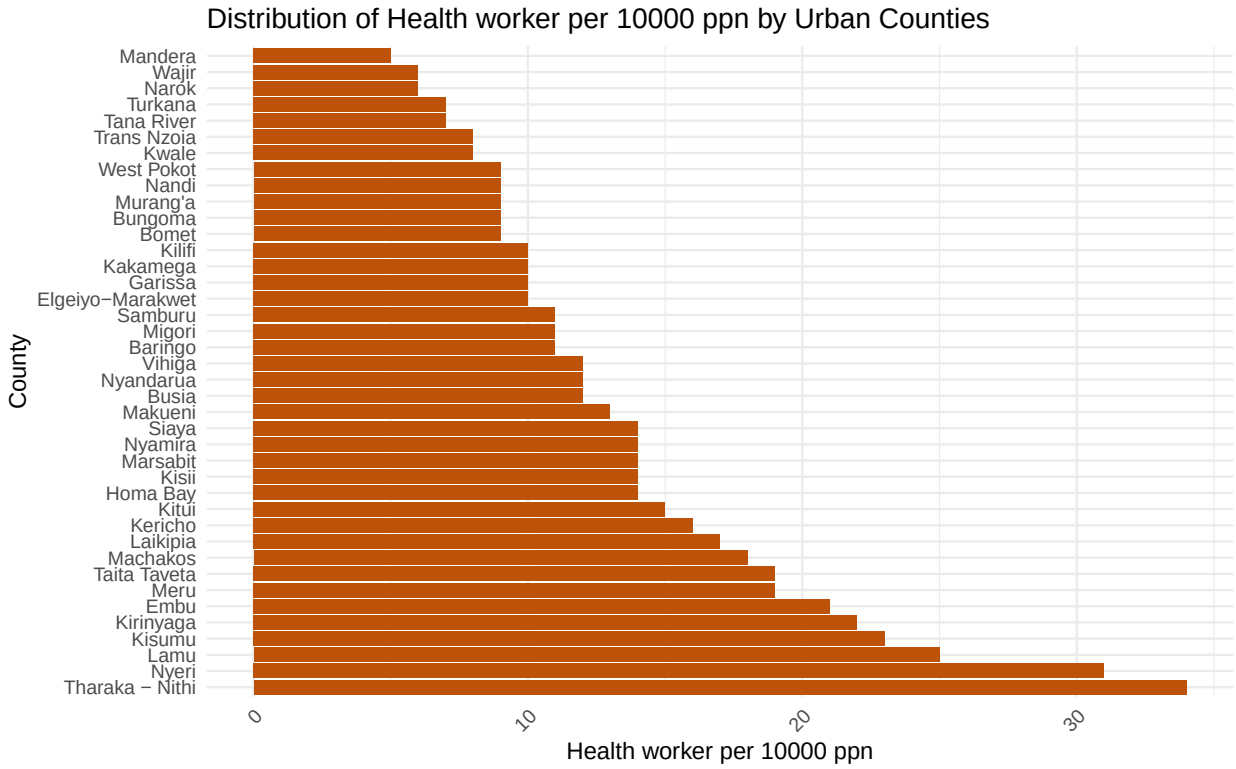
Bar charts showing Hospital Bed density per 10000 population by counties

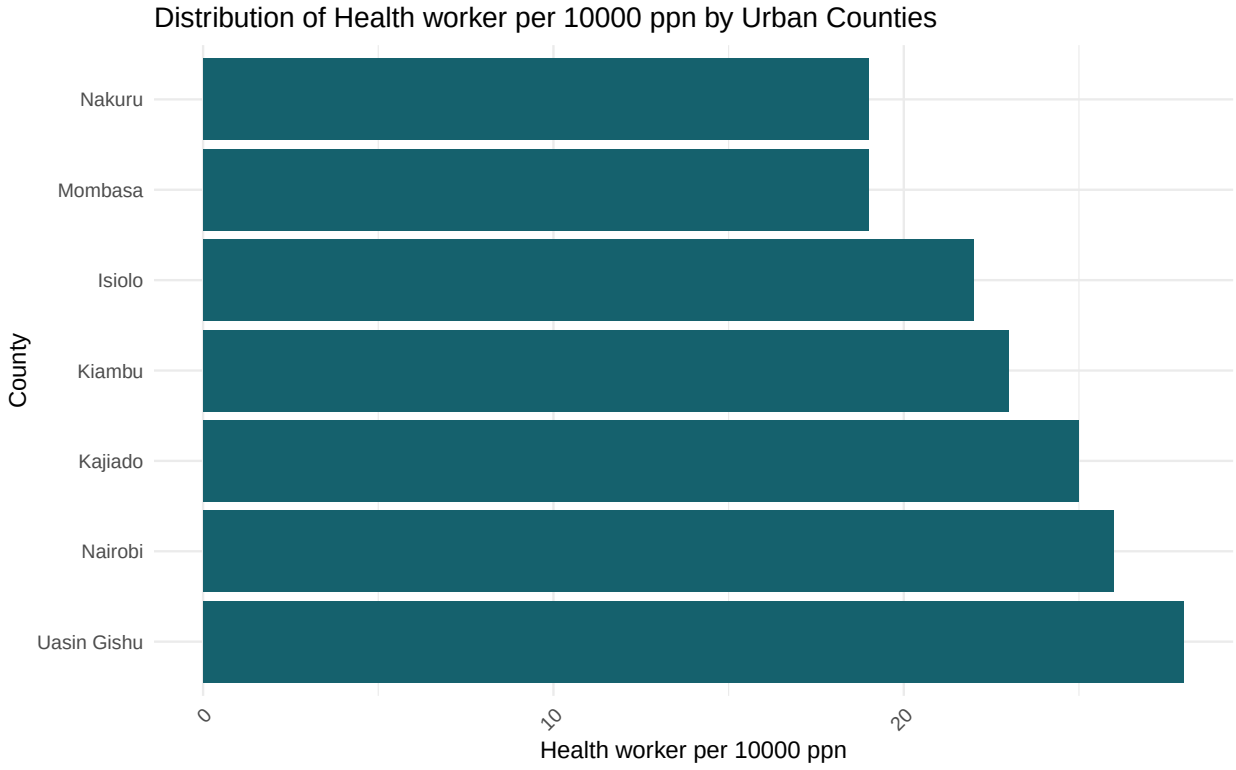
```
grid.arrange(fig7,fig8,ncol=1)
```



Barcharts showing Hospital worker per 10000 population Distribution by counties

```
grid.arrange(fig9,fig10,ncol=1)
```

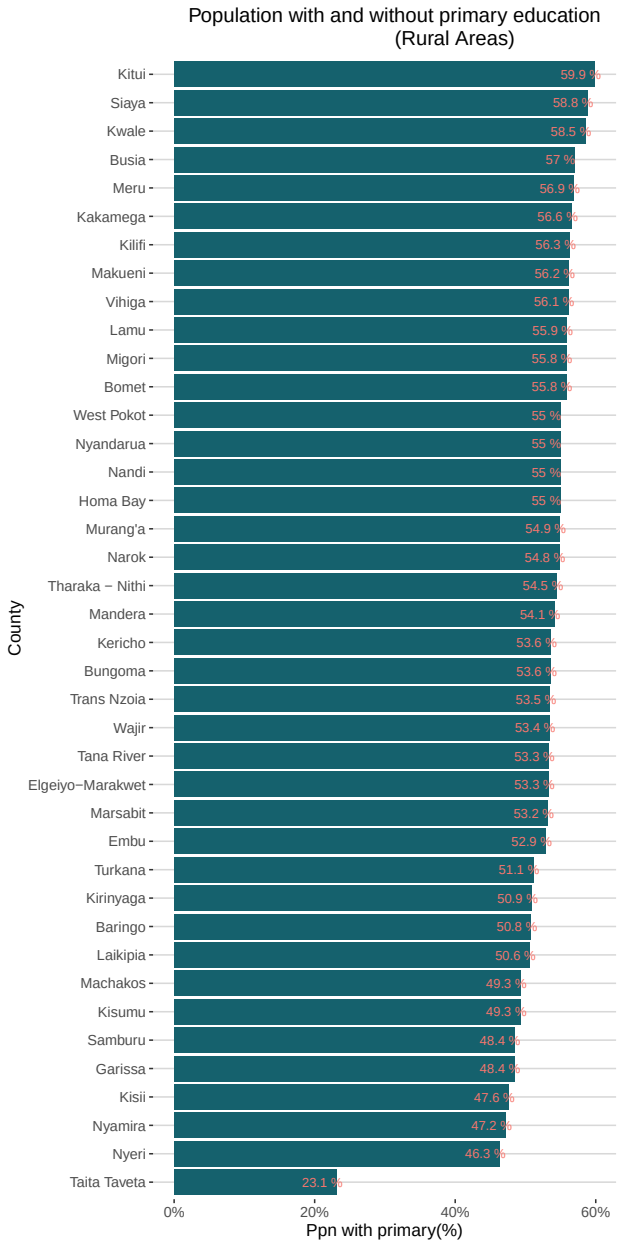


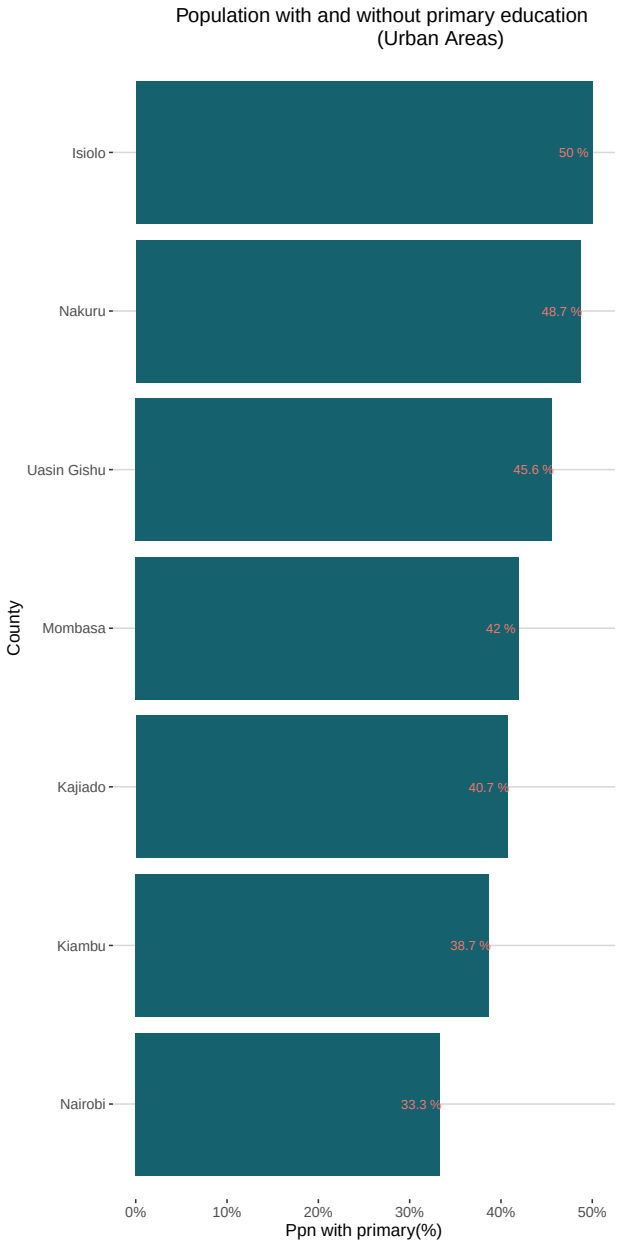


Rural-Urban Education dynamics

Primary school education

```
# find an arrangement index
y <- df %>%  select(County,`Ppn with primary(%)`,Status) %>% arrange(`Ppn with primary(%)`)
y$County <- factor(y$County,levels = y$County)

# create a graph for urban
rural <- y %>% filter(Status == 'Rural') %>% mutate(perc = paste(`Ppn with primary(%)`,'%')) %>%
  ggplot(aes(x = County,y  =`Ppn with primary(%)`,label = perc))+geom_bar(stat = 'identity',fill = colo
  #scale_fill_manual(values = c(colors[1],colors[7]))+
  labs(title = "Population with and without primary education\n (Rural Areas)")+scale_y_continuous(labe
  geom_text(aes(y = `Ppn with primary(%)` - 2, color = colors[2]), size = 3, position = position_dodge(
    plot.title = element_text(hjust = 0.7)  # Center the title
  )+
  theme_hc()

# create a graph for urban
urban <- y %>% filter(Status == 'Urban') %>% mutate(perc = paste(`Ppn with primary(%)`,'%')) %>%
  ggplot(aes(x = County,y  =`Ppn with primary(%)`,label = perc))+geom_bar(stat = 'identity',fill = colo
  #scale_fill_manual(values = c(colors[1],colors[7]))+
  labs(title = "Population with and without primary education\n (Urban Areas)")+scale_y_continuous(labe
  geom_text(aes(y = `Ppn with primary(%)` - 2, color = colors[2]), size = 3, position = position_dodge(
    plot.title = element_text(hjust = 0.7)  # Center the title
  )+
  theme_hc()
grid.arrange(rural,urban,ncol =2)
```

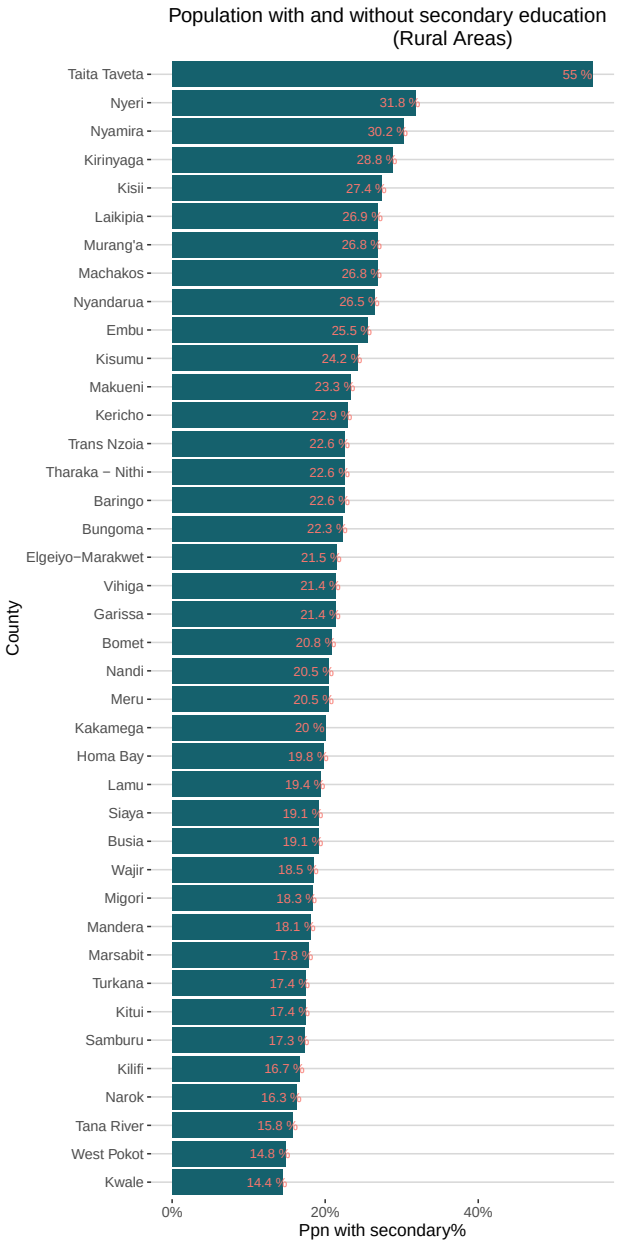


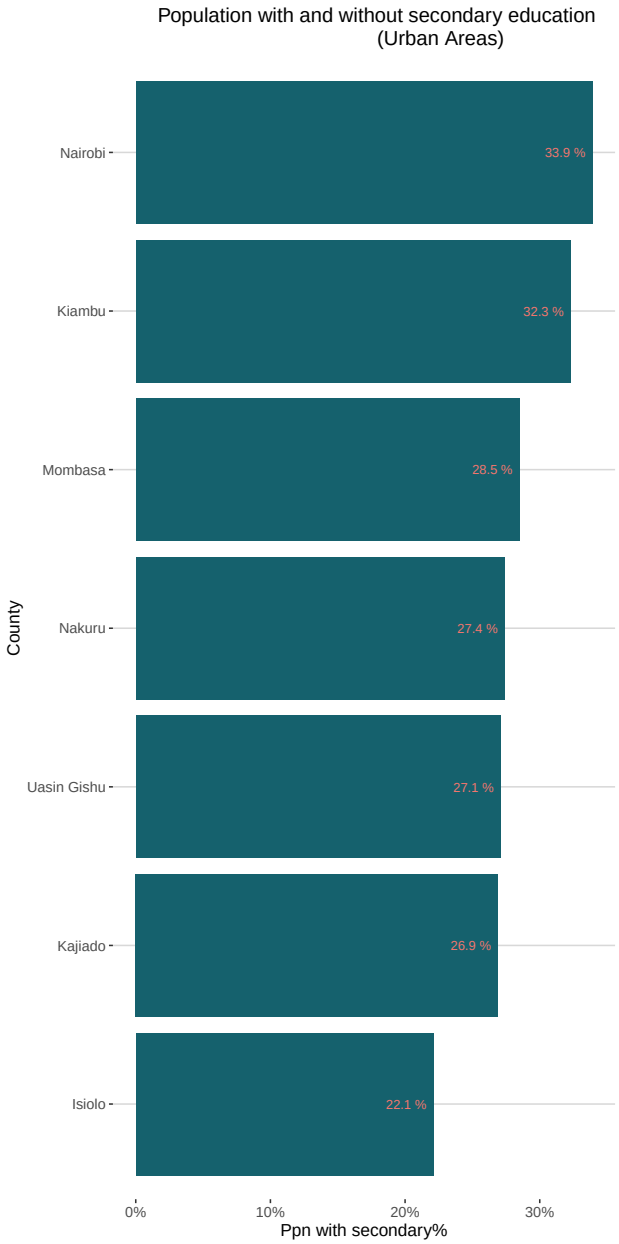


Secondary school education

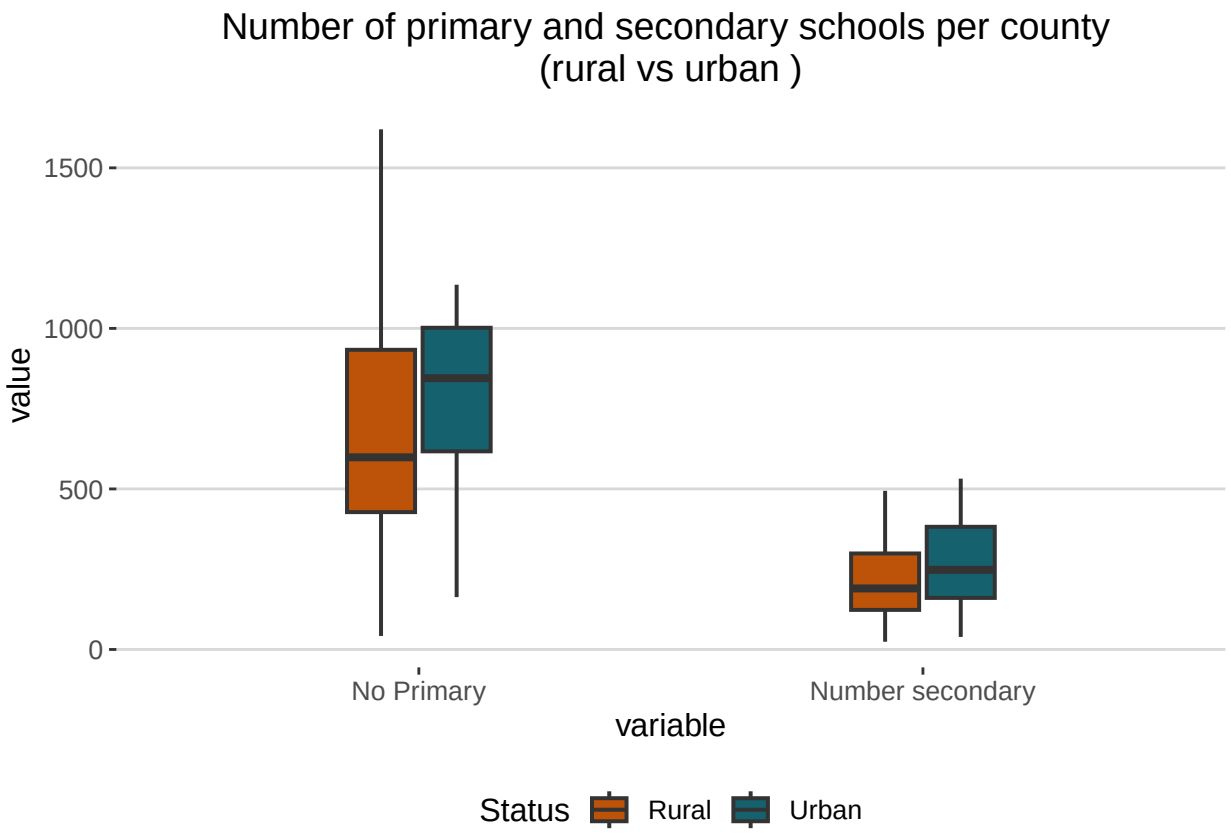
```
# find an arrangement index
y <- df %>%  select(County,`Ppn with secondary%`,Status) %>% arrange(`Ppn with secondary%`)
y$County <- factor(y$County,levels = y$County)



# create a graph for urban
rural <- y %>% filter(Status == 'Rural') %>% mutate(perc = paste(`Ppn with secondary%`,'%')) %>%
  ggplot(aes(x = County,y  =`Ppn with secondary%`,label = perc))+geom_bar(stat = 'identity',fill = colo
  #scale_fill_manual(values = c(colors[1],colors[7]))+
```

```
  labs(title = "Population with and without secondary education\n (Rural Areas)")+scale_y_continuous(lab
  geom_text(aes(y = `Ppn with secondary%` - 2, color = colors[2]), size = 3, position = position_dodge(w
    plot.title = element_text(hjust = 0.7)  # Center the title
  )+
  theme_hc()

# create a graph for urban
urban <- y %>% filter(Status == 'Urban') %>% mutate(perc = paste(`Ppn with secondary%`,'%')) %>%
  ggplot(aes(x = County,y  =`Ppn with secondary%`,label = perc))+geom_bar(stat = 'identity',fill = colo
  #scale_fill_manual(values = c(colors[1],colors[7]))+
  labs(title = "Population with and without secondary education\n (Urban Areas)")+scale_y_continuous(lab
  geom_text(aes(y = `Ppn with secondary%` - 2, color = colors[2]), size = 3, position = position_dodge(w
    plot.title = element_text(hjust = 0.7)  # Center the title
  )+
  theme_hc()
grid.arrange(rural,urban,ncol =2)
```






```
df %>% select(Status,`No Primary`,`Number secondary`) %>%
  melt(id.vars = 'Status') %>%
  ggplot(aes(x = variable,y =value,fill = Status))+geom_boxplot(width = 0.3, size = 0.7)+
  theme_hc()+
  labs(title = "Number of primary and secondary schools per county \n(rural vs urban )")+
  theme(
    plot.title = element_text(hjust = 0.5)  # Center the title
  )+
  scale_fill_manual(values = c(colors[1],colors[7]))
```



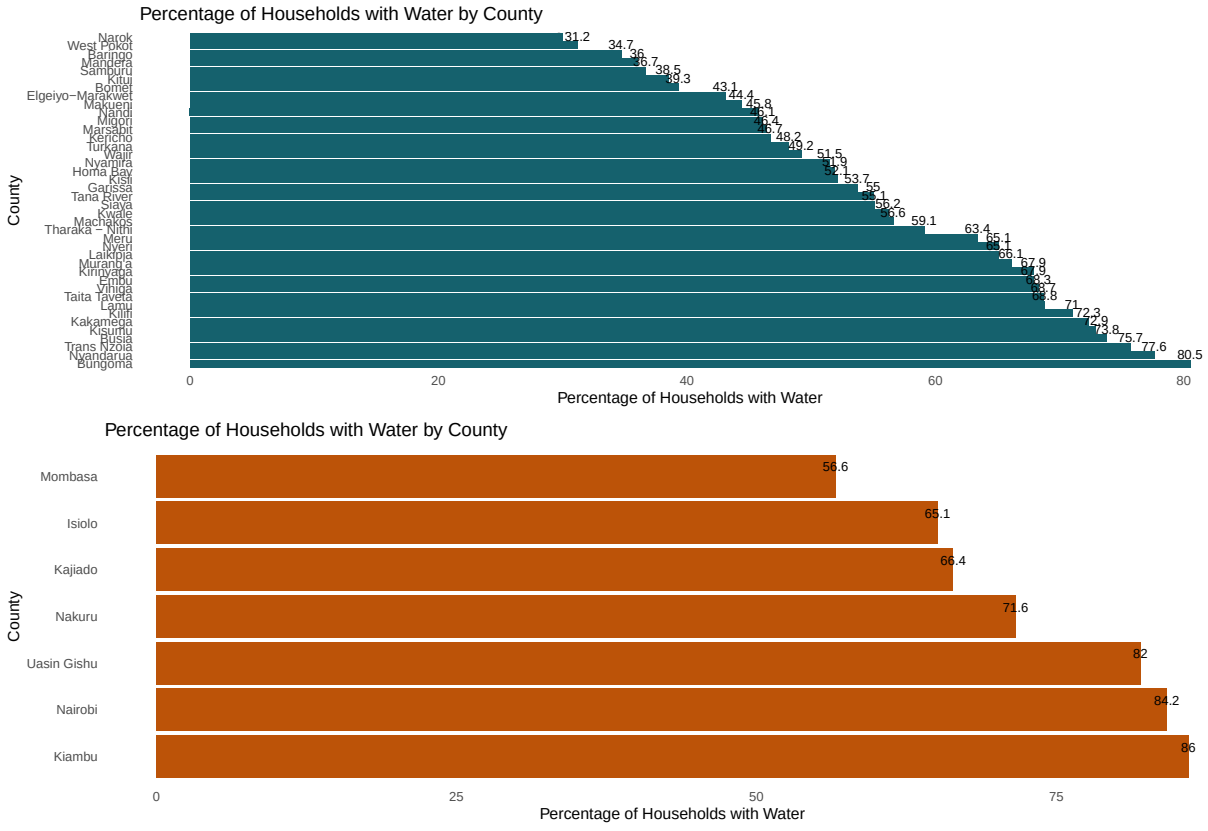
Rural-Urban Misc

```
water_county <-kenya1 %>%
  filter(Status== "Rural") %>%
  select("County","Status","Households with water %")

fig1<- ggplot(water_county, aes(x = reorder(County, -`Households with water %`), y = `Households with wa
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill = '#15616D') +
  geom_text(aes(label = `Households with water %`), vjust = -0.5,hjust =0.5, size = 3)+
  labs(title = "Percentage of Households with Water by County",
       x = "County",
       y = "Percentage of Households with Water") +
  theme_minimal()+
  coord_flip()+
   theme(panel.grid = element_blank())
```

```
water_county <-kenya1 %>%
  filter(Status== "Urban") %>%
  select("County","Status","Households with water %")

fig2<- ggplot(water_county, aes(x = reorder(County, -`Households with water %`), y = `Households with wa
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE,fill = '#BC5308') +
  geom_text(aes(label = `Households with water %`), vjust = -0.5,hjust =0.5, size = 3)+
```

```
  labs(title = "Percentage of Households with Water by County",
       x = "County",
       y = "Percentage of Households with Water") +
  theme_minimal()+
  coord_flip()+
  theme(panel.grid = element_blank())
```

```
grid.arrange(fig1,fig2,ncol=1)
```

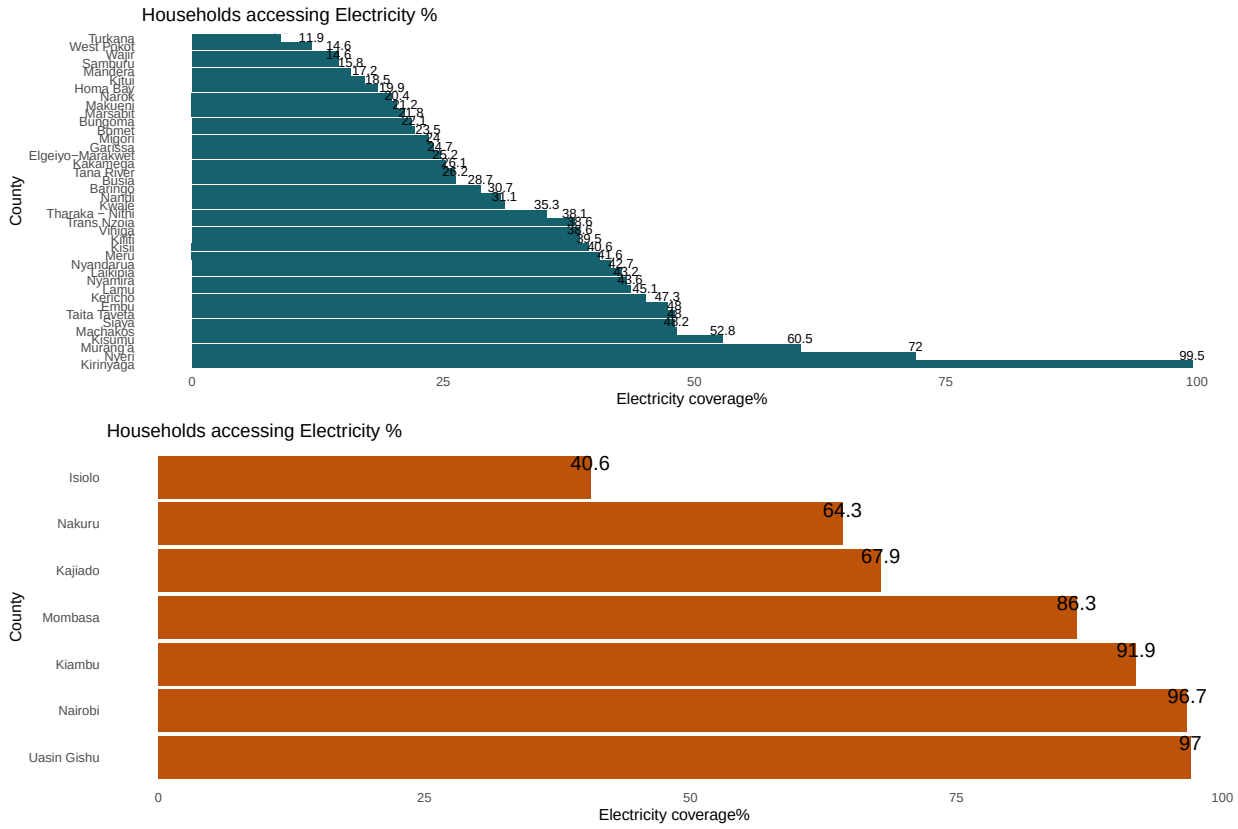



```
# water_county
```

```
Electricity_county<-kenya1 %>%
  filter(Status=="Rural") %>%
  select("County","Status","Household with Electricity %") %>%
  arrange(`Household with Electricity %`)
fig3<-ggplot(Electricity_county, aes(x = reorder(County, -`Household with Electricity %`), y = `Househol
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill= '#15616D') +
  geom_text(aes(label = `Household with Electricity %`), vjust = -0.5,hjust =0.5, size = 3)+
  labs(title = "Households accessing Electricity %",
       x = "County",
       y = "Electricity coverage%") +
  theme_minimal()+
  coord_flip()+
   theme(panel.grid = element_blank())
```

```
Electricity_county<-kenya1 %>%
  filter(Status=="Urban") %>%
  select("County","Status","Household with Electricity %") %>%
  arrange(`Household with Electricity %`)
fig4<-ggplot(Electricity_county, aes(x = reorder(County, -`Household with Electricity %`), y = `Household
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE,fill= '#BC5308') +
  geom_text(aes(label = `Household with Electricity %`), vjust = -0.5,hjust =0.5, size = 5)+
  labs(title = "Households accessing Electricity %",
       x = "County",
       y = "Electricity coverage%") +
  theme_minimal()+
  coord_flip()+
   theme(panel.grid = element_blank())
```

```
grid.arrange(fig3,fig4,ncol=1)
```

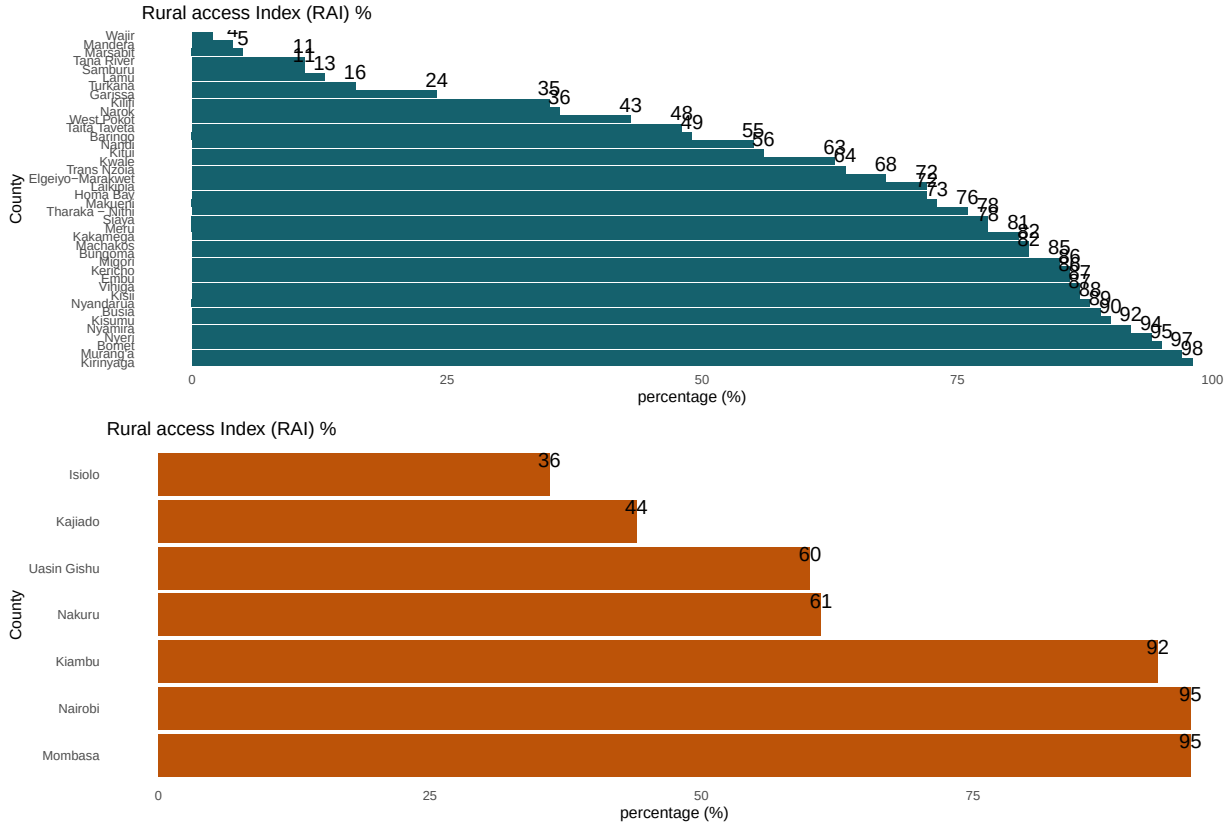



```
Rural_index_county<-kenya1 %>%
  filter(Status=="Rural") %>%
  select("County","Status","Rural Access Index%")

fig5<- ggplot(Rural_index_county, aes(x = reorder(County,-`Rural Access Index%`), y = `Rural Access Inde
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE,fill ='#15616D') +
  geom_text(aes(label = `Rural Access Index%`), vjust = -0.5,hjust =0.5, size = 5)+
  labs(title = "Rural access Index (RAI) %",
       x = "County",
       y = "percentage (%)") +
```

```
  theme_minimal()+
  scale_fill_manual(values = colors)+
  coord_flip()+
  theme(panel.grid = element_blank())
```

```
Rural_index_county<-kenya1 %>%
  filter(Status=="Urban") %>%
  select("County","Status","Rural Access Index%")

fig6<- ggplot(Rural_index_county, aes(x = reorder(County,-`Rural Access Index%`), y = `Rural Access Inde
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill = '#BC5308') +
  geom_text(aes(label = `Rural Access Index%`), vjust = -0.5,hjust =0.5, size = 5)+
  labs(title = "Rural access Index (RAI) %",
       x = "County",
       y = "percentage (%)") +
  theme_minimal()+
  scale_fill_manual(values = colors)+
  coord_flip()+
  theme(panel.grid = element_blank())
```

```
grid.arrange(fig5,fig6,ncol=1)
```

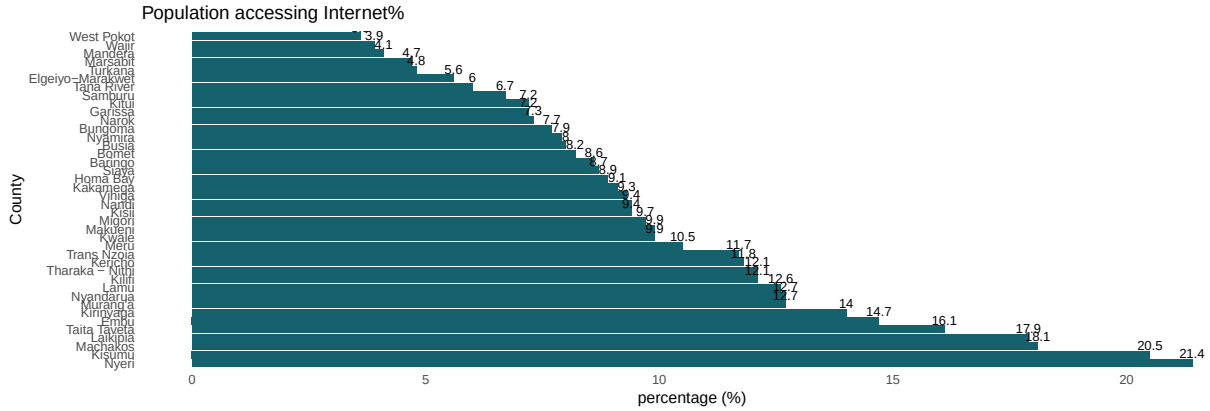


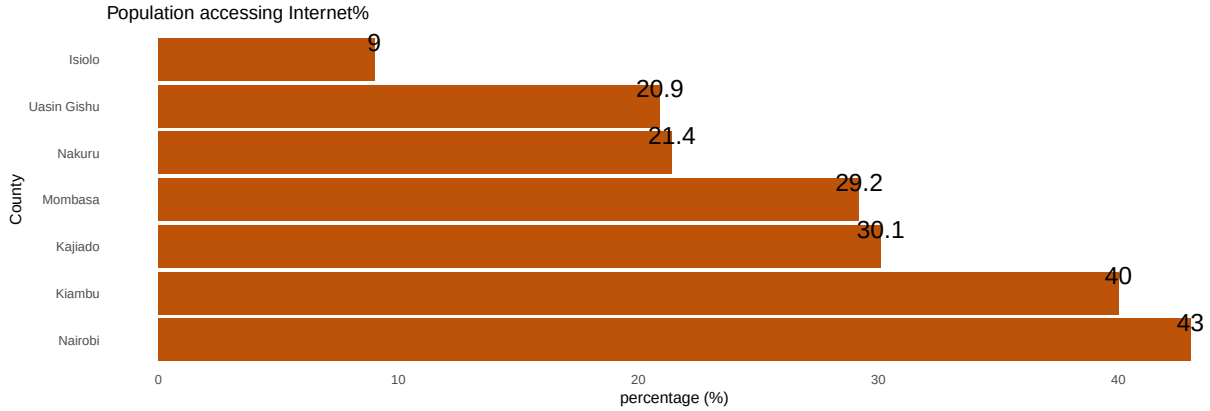

```
Internet_county<-kenya1 %>%
  filter(Status =="Rural") %>%
  select("County","Status","population accessing internet%")
```

```
fig7<- ggplot(Internet_county, aes(x = reorder(County,-`population accessing internet%`), y = `populatio
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill = '#15616D') +
  geom_text(aes(label = `population accessing internet%`), vjust = -0.5,hjust =0.5, size = 3)+
  labs(title = "Population accessing Internet%",
       x = "County",
       y = "percentage (%)") +
  theme_minimal()+
  scale_fill_manual(values = colors)+
  coord_flip()+
  theme(panel.grid = element_blank())
```

```
Internet_county<-kenya1 %>%
  filter(Status =="Urban") %>%
  select("County","Status","population accessing internet%")

fig8<-ggplot(Internet_county, aes(x = reorder(County,-`population accessing internet%`), y = `populatio
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE,fill = '#BC5308') +
  geom_text(aes(label = `population accessing internet%`), vjust = -0.5,hjust =0.5, size = 6)+
  labs(title = "Population accessing Internet%",
       x = "County",
       y = "percentage (%)") +
  theme_minimal()+
  scale_fill_manual(values = colors)+
  coord_flip()+
  theme(panel.grid = element_blank())
```

```
grid.arrange(fig7,fig8,ncol=1)
```



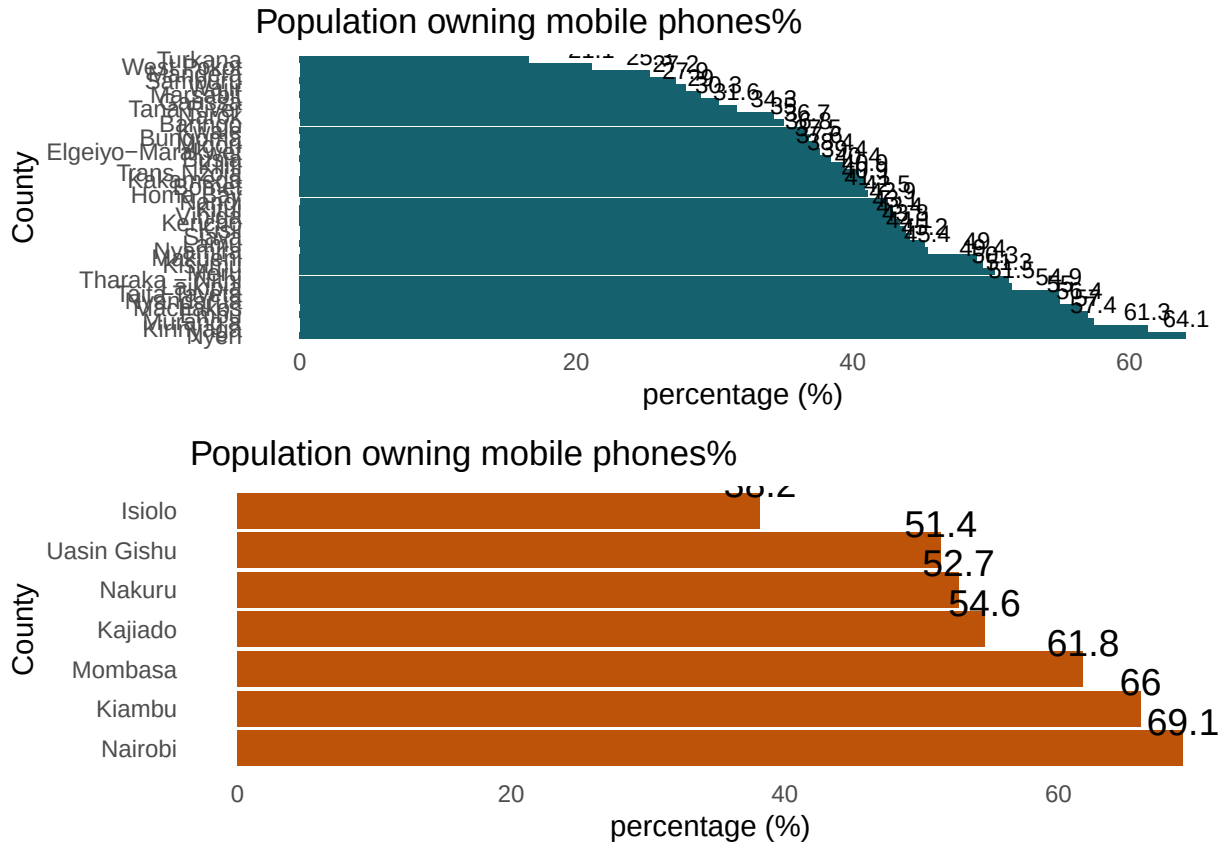



```
mobile_phones<-kenya1 %>%
  filter(Status == "Rural") %>%
  select("County","Status","population owning mobile phones%")

fig9<- ggplot(mobile_phones, aes(x = reorder(County, -`population owning mobile phones%`), y = `populati
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill ='#15616D') +
  geom_text(aes(label = `population owning mobile phones%`), vjust = -0.5,hjust =0.5, size = 3)+
  labs(title = "Population owning mobile phones%",
       x = "County",
       y = "percentage (%)") +
  theme_minimal()+
  scale_fill_manual(values = colors)+
  coord_flip()+theme(panel.grid = element_blank())
```

```
mobile_phones<-kenya1 %>%
  filter(Status == "Urban") %>%
  select("County","Status","population owning mobile phones%")

fig10<- ggplot(mobile_phones, aes(x = reorder(County, -`population owning mobile phones%`), y = `popula
  geom_bar(stat = "identity", position = "dodge",show.legend = FALSE, fill = '#BC5308') +
  geom_text(aes(label = `population owning mobile phones%`), vjust = -0.5,hjust =0.5, size = 5)+
  labs(title = "Population owning mobile phones%",
       x = "County",
       y = "percentage (%)") +
  theme_minimal()+
  scale_fill_manual(values = colors)+
```

```
  coord_flip()+theme(panel.grid = element_blank())
```

```
library(gridExtra)
grid.arrange(fig9,fig10,ncol=1)
```



findings and conclusion