

# **ANALYZING BATAAN GENERAL HOSPITAL AND MEDICAL CENTER'S COVID-19 PROCUREMENT INITIATIVES**

**Jeffrey Banico, Christine Bolaños, Meraflor Genovania,**

**Vincent Reperoga, Hannah Sophia Revoltar**

College of Science, Bicol University, Legazpi City Albay, Philippines

Coronavirus disease (COVID-19) is the one that has set the global population in an extensively menacing economic and health quandary. According to the Philippine Statistics Authority (PSA), it was ranked as the country's seventh leading cause of death in 2020, but has already jumped to fifth this year. Facts and figures unveiled by OCTA Research suggest that Region III (Central Luzon), with the province of Bataan listed as one of the top 20 localities with soaring number of cases, is the third among the 17 regions in the Philippines that has been extremely jolted by the pandemic.

Along the frameworks and initiatives of World Health Organization (WHO), Inter-Agency Task Force on Emerging Infectious Diseases (IATF), and Local Government Units (LGUs), measures to keep a tight rein on the looming threats and harm brought about by COVID-19 were rigorously set in motion. Bataan General Hospital and Medical Center (BGHMC) is among the first-rated healthcare institutions in Region III which has initially been adapted as a COVID-19 dedicated hospital within the country, right at the onset of the pandemic. On grounds of earlier studies, with data consolidated from November of 2020, BGHMC has been declared to have demonstrated a remarkable performance anent the implementation of COVID-19 measures. Evaluation was painstakingly undertaken on the basis of factors including but not limited to the number of healthcare providers and front liners, facilities, and working population.

Supplementary to the initial investigations, this study accordingly sets its sights on providing comprehensive, well-founded procurement analytics of Bataan General Hospital and

Medical Center during the fourth quarter of the preceding year. More specifically, this study will determine and classify items procured by BGHMC as measures to COVID-19 during October to December 2020. It will also identify business categories of highest approved contract budget and categorize items for procurement with their corresponding total budget allocation. For the most part, this study seeks to provide holistic visual representation of BGHMC's procurement efforts as measures to COVID-19.

### **QUESTIONS**

Bataan General Hospital and Medical Center's procurement of items inclined to COVID-19 pandemic during October to December 2020 was the identified focus of the study. Specifically, this paper seeks to answer the following questions:

- 1. Which among the business categories receives the largest percentage of BGHMC's approved contract budget?**
- 2. What are the items procured by BGHMC as measures to COVID-19 during the fourth quarter of the year 2020?**
- 3. What is the total budget allocation of BGHMC for COVID-19 during the fourth quarter of the year 2020?**

## METHODOLOGY

This section presents the overall methods as well as the software, libraries, packages, and tools used in the conduct of the study.

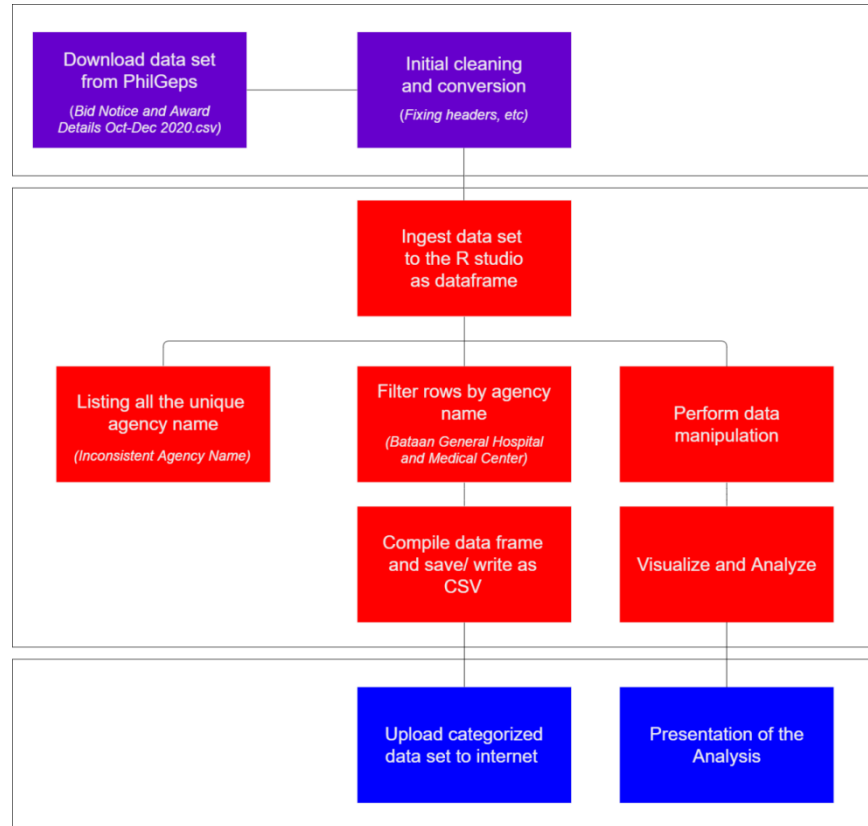


Figure 1. PhilGeps Data Pre-processing, Preparation, and Visualization

The data utilized for this study were obtained from the Philippine Government Electronic Procurement System (PhilGEPS), a government procurement electronic portal. The data set of interest contains 40 columns and 244,771 rows of observable data from the government's procurement released in the fourth quarter of 2020. After being imported in CSV file format, the dataset was filtered using R studio in order to be cleaned, likened, and adhere to standard consistency. Only the data from the organization "*Bataan General Hospital and Medical Center*" was filtered and designated as the study's primary focus, yielding 2642 rows of relevant data. In the best interest of consolidating pertinent information about the items purchased by the hospital

in response to COVID-19, the parameters were set and actual keywords were used: “*COVID-RELATED*”, “*COVID USE*”, and “*PCR Lab*”. All of which were listed as item descriptions purchased by the hospital during the pandemic. In terms of the collected data, only a total of 38 rows were observed and used to complete the study. After thoroughly cleansing the data, R studio was employed to visualize the consolidated data and ideally come to an acceptable and reliable interpretation as well as conclusion of significant findings.

The following are the salient tools, libraries, and packages employed for the purpose of data processing and visualization:

**R programming language** is an open source statistical computing and graphics programming language. It is used to create a graphical representation of the data set.

**R studio** is an open source IDE for R programming. It makes use of the user interface to make it simple to manipulate the data that has been ingested in R.

**Tidyverse** is a data science-focused R package collection. This includes the dplyr, ggplot2, and stringr, which are used for data visualization.

**Dplyr** is a data manipulation tool package that provides a standardized set to solve the most common data manipulation problems. This is used in the study to filter the data set into a specific desire and focus where the researcher can manipulate the data.

**Ggplot2** is one of the tidyverse-supported packages for creating graphics. This package is used in the study to visualize the data in the desired graphical format.

**Scales** package is used to customize the appearance of the axis and legend labels in the graph. Therefore, in the study it used to modify the labels presented in the graph to make it more presentable and professional.

**Treemapify** is a function that generates treemap coordinates using rectangles to represent each observation. In the study, this is used to show the percentage distribution of the BGHMC's overall acquired business category.

**Wesanderson** is a package comprised of different color palettes. This is utilized in the study for rendering optimal viewing of the graphs.

## RESULTS AND DISCUSSION

This section of the study aims to provide a comprehensive, well-founded interpretation and visualization of BGHMC's procurement analytics.

1. *Which among the business categories receives the largest percentage of BHGMC's approved contract budget?*

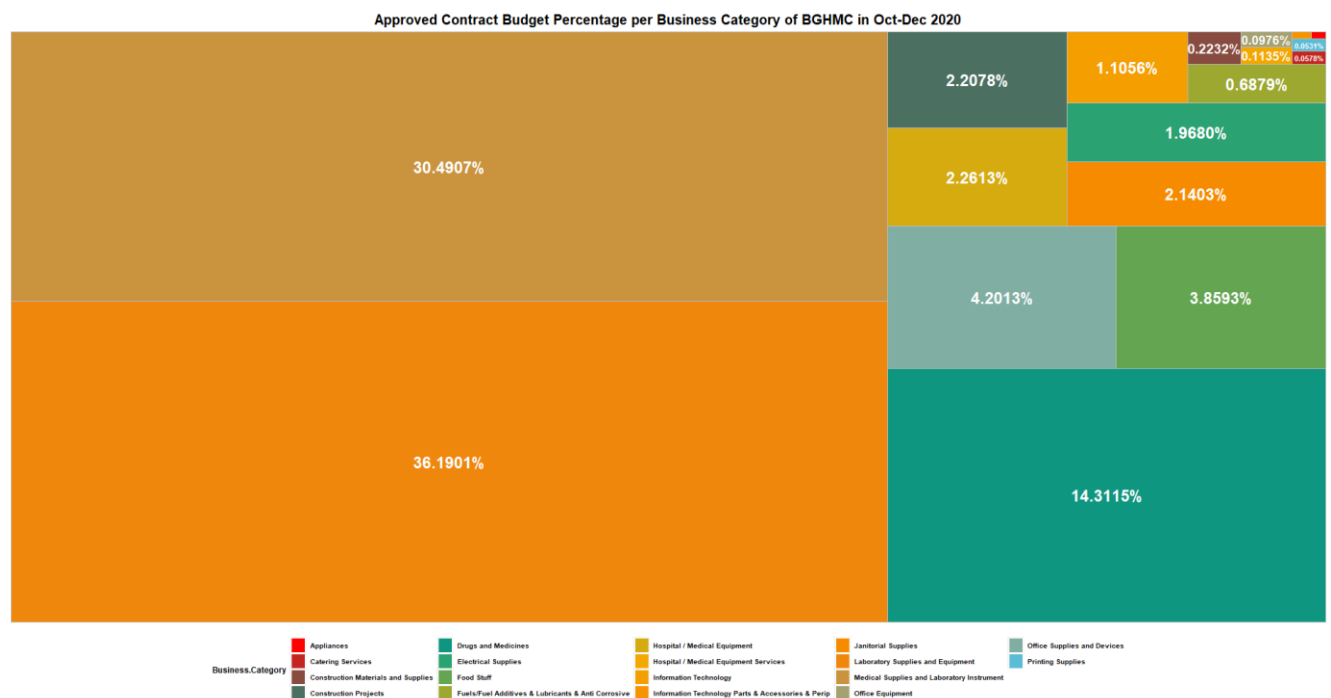
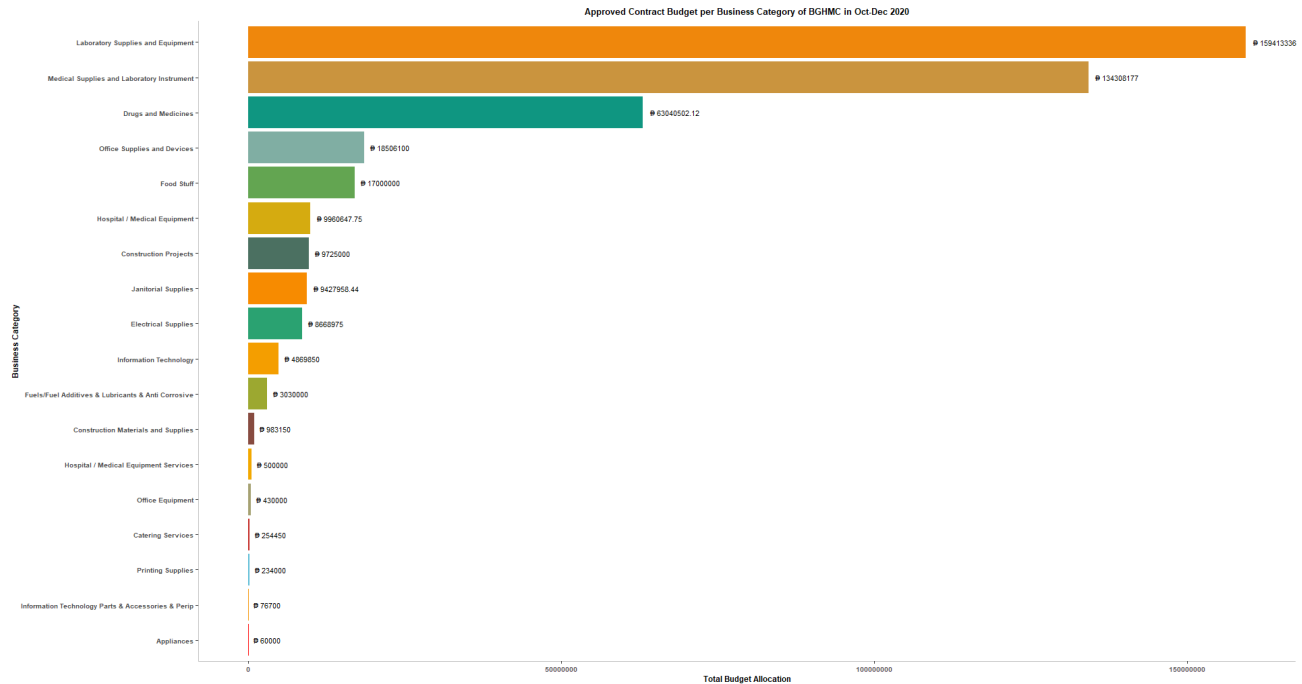


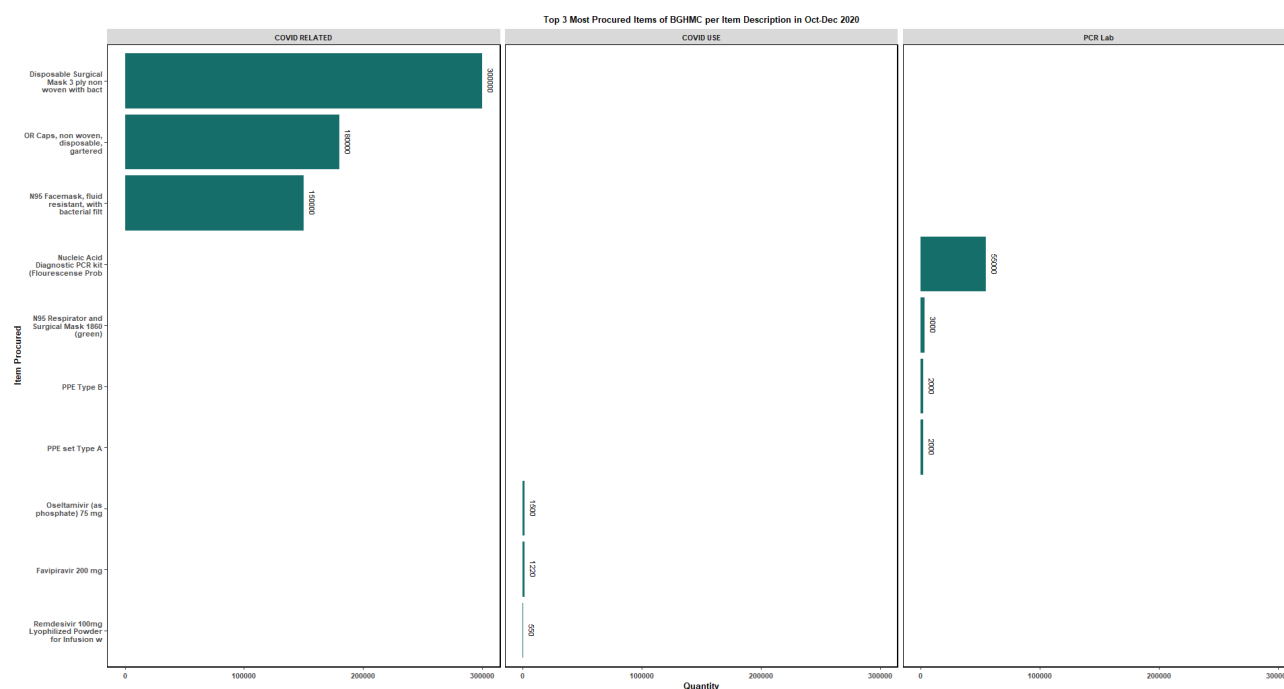
Figure 2. **Approved Contract Budget Percentage per Business Category of BGHMC in Oct-Dec 2020**



**Figure 2.1 Approved Contract Budget per Business Category of BGHMC in Oct-Dec 2020**

The figures above aim to determine which of the business categories acquired the largest percentage of Bataan General Hospital and Medical Center's (BGHMC) approved contract budget according to the October – December of 2020 dataset, which falls on the fourth quarter of the year 2020. Upon visualizing the filtered data, it shows that Laboratory Supplies and Equipment received 36.1901% of the budget equivalent to ₱15,000,000.00 in total, followed by Medical Supplies and Laboratory Instruments, which received over 30.4907% of the total budget which is account to ₱13,308,177.00, making them the highest budget recipients of BGHMC in the fourth quarter of 2020. While the business category that has the lowest approved contract budget percentage is the Appliances with only 0.0136%, ₱ 60,000.00 in equivalent value. This clearly indicates that BGHMC is directing more funds to the acquisition of medical and laboratory supplies, as well as laboratory equipment and instruments, in preference to other business categories, such as appliances.

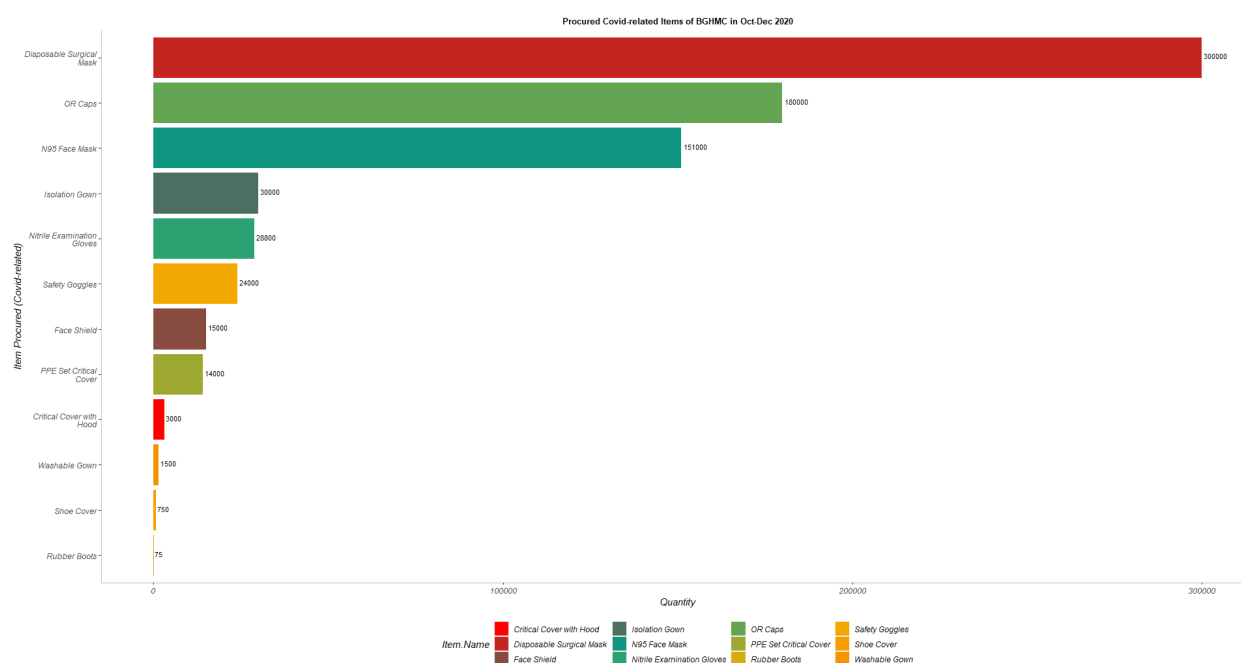
2. ***What are the items procured by BGHMC as measures to Covid-19 during the fourth quarter of the year 2020?***



**Figure 3. Top 3 Most Procured Items of BGHMC as Covid-19 Measures in Oct-Dec 2020**

This study primarily endeavors to provide the list of items with the highest procurement per item description (Covid-related, Covid Use, Polymerase Chain Reaction (PCR) Lab) with an underlying intent to navigate through each of the item procured by Bataan General Hospital and Medical Center (BGHMC) as measures to Covid-19 pandemic. As shown in Figure 3, BGHMC pivoted its concern predominantly on Covid-related Medical Supplies and Laboratory Equipments with Disposable Surgical Masks, OR Caps, and N95 Face Masks as the three most procured items within the Covid-related category. PCR Laboratory Supplies and Equipments, with the second highest number of total procurement, having Nucleic Acid Diagnostic PCR Kits, N95 Respirator and Surgical Masks as top one and two, respectively. The two sets of Personal Protective Equipment (PPE), Type A and B, tied with the same quantity, as the top three within the PCR lab category. Lastly, Drugs and Medicines for Covid Use obtained the least number of

procurements with Oseltamivir, Favipiravir, and Remdesivir as top and only three items for Covid-use category. In essence, during the fourth quarter (October-December) of the year 2020, procurement of Covid-related Medical Supplies and Laboratory Equipments was the topmost priority of BGHMC, and Drugs and Medicines for Covid Use set as the least, in terms of measures against Covid-19 pandemic.

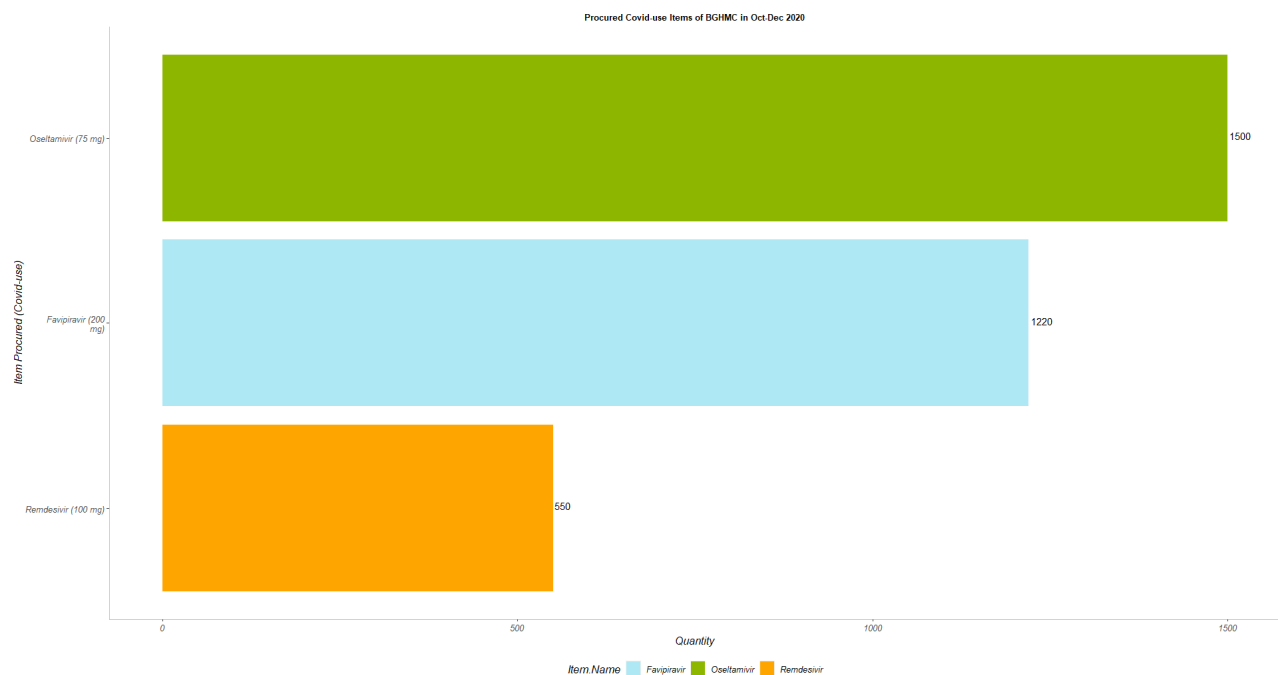


**Figure 3.1 Procured Covid-related Items of BGHMC in Oct-Dec 2020**

As shown in Figure 3.1, results substantiated that among all the Covid-related items procured by Bataan General Hospital and Medical Center, Disposable Surgical Masks secured the principal number of acquisitions during the fourth quarter of the year 2020. With a total of 300,000 stocks in quantity, it is second to none on the subject of basic and most essential preventive measures against the Covid-19 pandemic. In the business category of Medical Supplies and Laboratory Equipment, OR Caps were also deemed of paramount importance with 180,000 pieces purchased by BGHMC, followed by N95 Face Masks with 151,000 pieces in



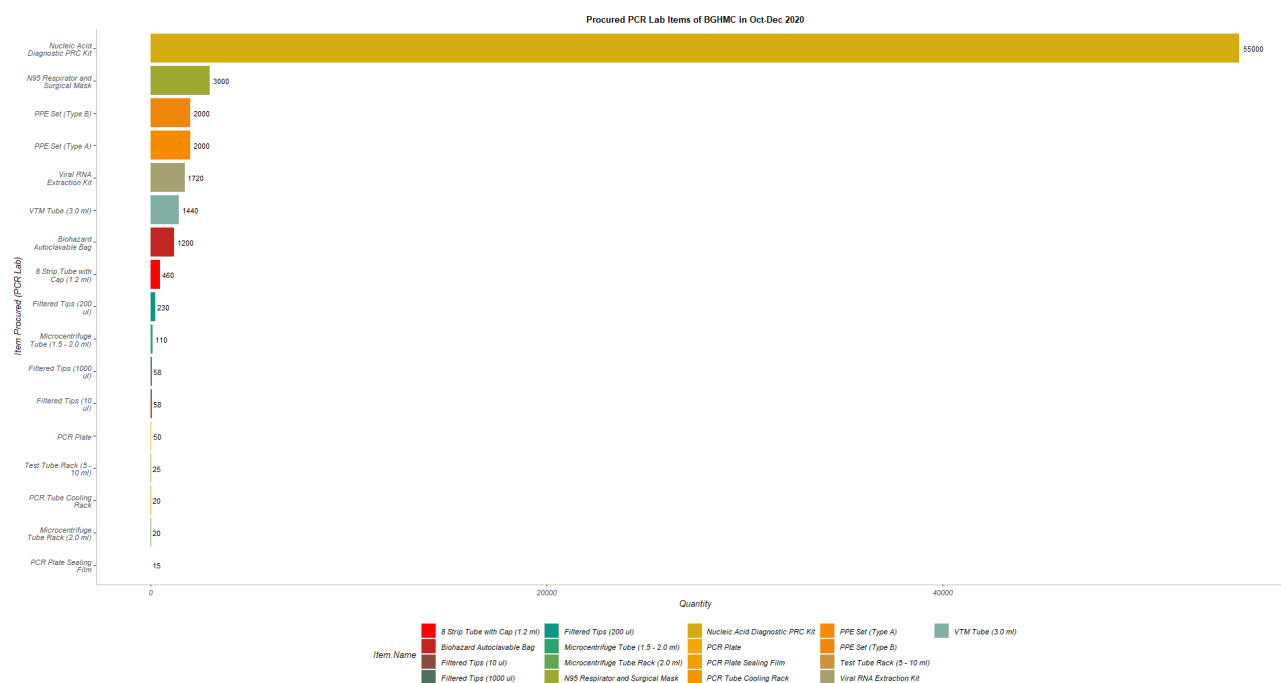
total supply. Washable Gown, Shoe Cover, and Rubber Boots, however, covered the bottom quarter of the list of procured items by the organization with 1500 pieces, 750 packs, and 75 pairs, respectively. On a reasonable account, Covid-related items of lowest procurement were not estimated to be as indispensable as face masks, and therefore, cannot be placed both on equal footing, albeit they can be used as protective measures in performing laboratory undertakings which may or may not be associated with Covid-19.



**Figure 3.2 Procured Covid-use Items of BGHMC in Oct-Dec 2020**

In the business category of Drugs and Medicines, Oseltamivir, Favipiravir, and Remdesivir are the only medicinal substances and therapeutic drugs obtained by Bataan General Hospital and Medical Center for covid use in the fourth quarter of the year 2020. These are known to be antiviral medications used in the best interest of treating influenza virus, including SARS-CoV-2. The figure above explicitly illustrates that Oseltamivir of 75 milligrams is of highest procurement and Remdesivir of 100 milligrams is of lowest. Oseltamivir was primarily

and preferably used in top-performing hospitals, both local and international, exhibiting optimal results and efficacy in the treatment of Covid-19 patients with symptomatic cases.



**Figure 3.3 Procured PCR Lab Items of BGHMC in Oct-Dec 2020**

As an initiative to mitigate and bridle the burgeoning impacts of Covid-19, Polymerase Chain Reaction (PCR) Laboratory Supplies and Equipments were also prioritized in parallel with Covid-related and Covid-use measures. Among the PCR Lab items procured by Bataan General Hospital and Medical Center, Nucleic Acid Diagnostic PCR Kit dominated the list, having a procurement quantity of 55,000 units, as presented in the Figure 3.3. Laboratory tests performed using these PCR Kits can efficiently detect the presence of the genetic material from a potential virus. BGHMC also invested in the procurement of N95 Respirator and Surgical Masks, Personal Protective Equipment (PPE) Sets, and Viral RNA Extraction Kits as additional measures in response and resistance to the Covid-19 pandemic.

3. **What is the total budget allocation of BHGMC for Covid-19 during the fourth quarter of the year 2020?**

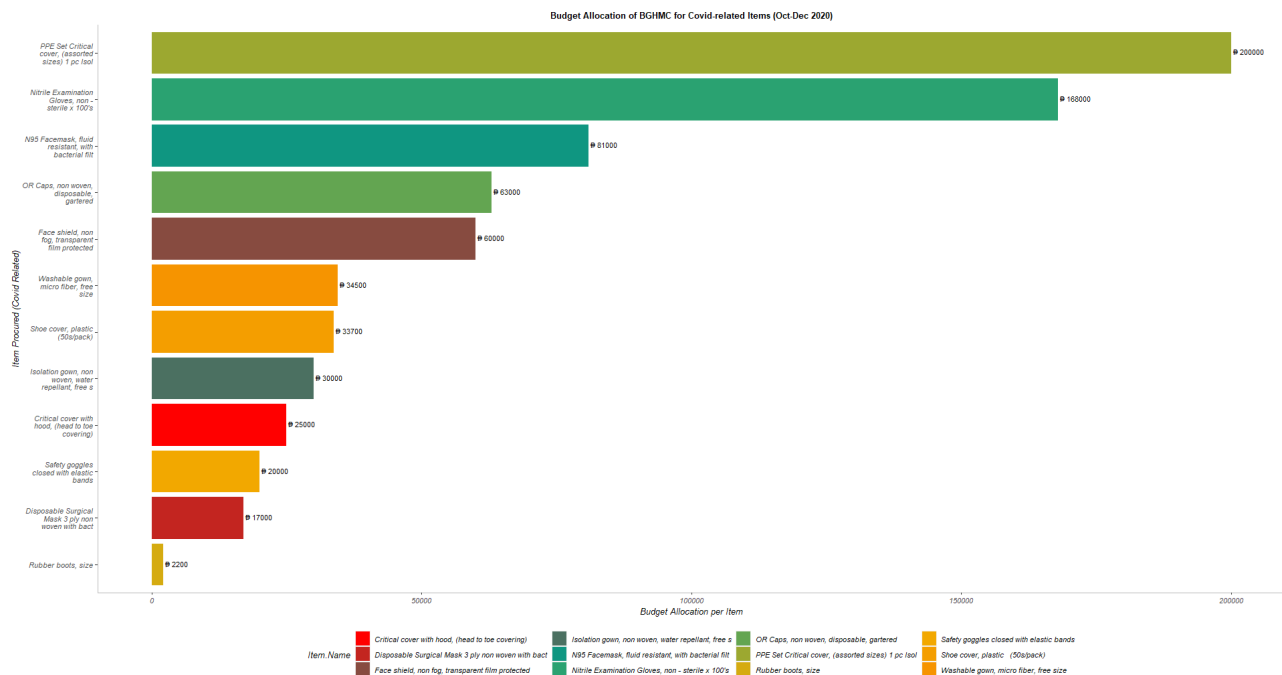
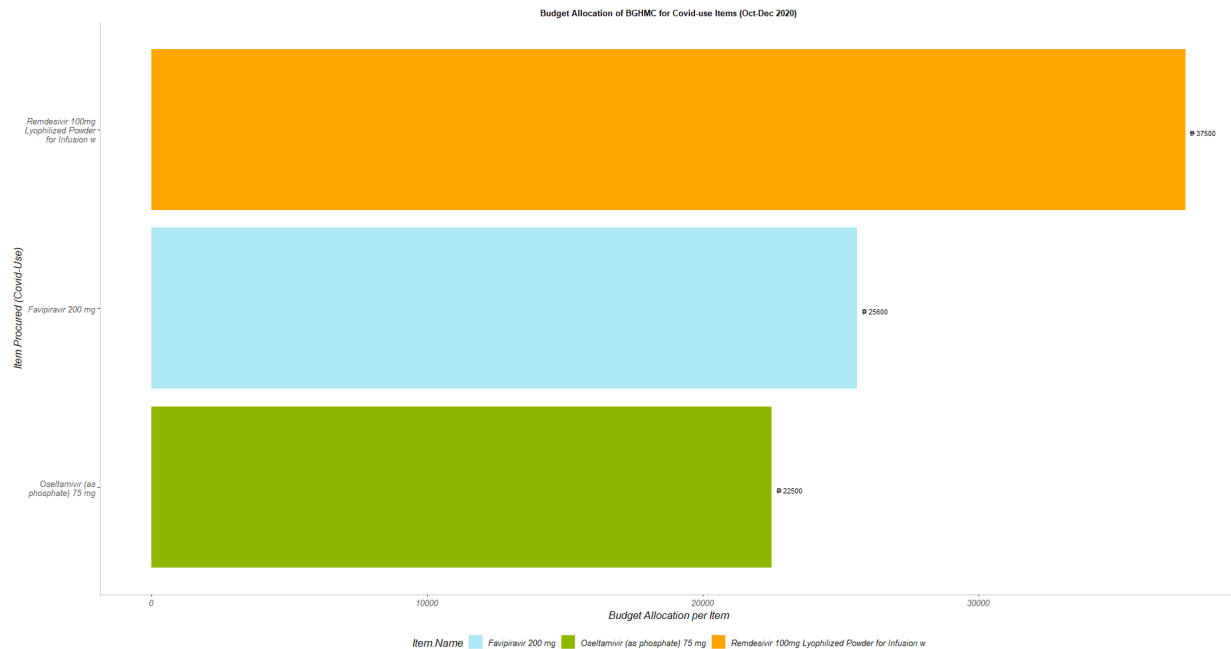


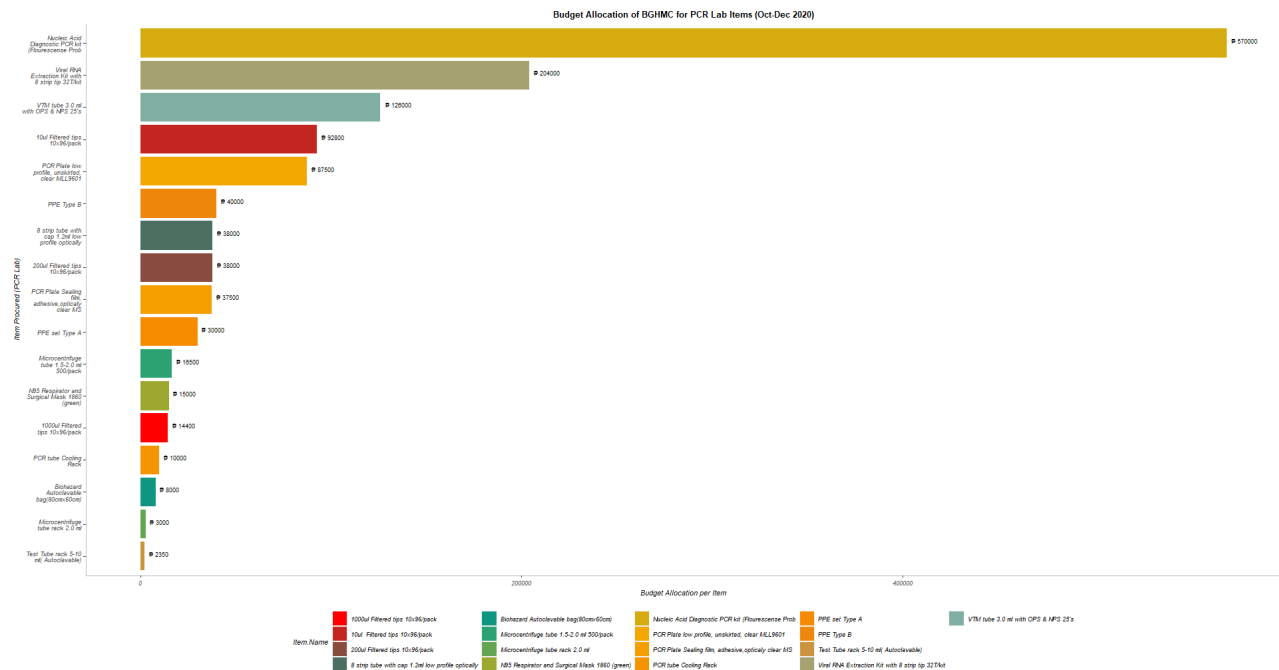
Figure 4. **Budget Allocation of BGHMC for Covid-related Items(Oct-Dec 2020)**

In terms of Covid-related expenditures, the amount allotted for the Covid-related items utilized by the Bataan General Hospital and Medical Center are shown in Figure 4. This visual exhibits that the PPE Set Critical cover, (assorted sizes) 1 pc Isol with ₱21,000,000 is the one that has the greatest amount of budget among the other 11 items followed by Nitrile Examination Gloves, non-sterile x 100's as the second and N95 Facemask, fluid resistant, with bacterial filter as the third. This indicates that PPE has the largest share in BHGMC's budget in the fourth quarter of 2020 in Covid-related category; this is used primarily to protect medical staff and employees when dealing with patients. On the other hand, the Rubber boots obtained the lowest budget allocated with only ₱22,500.



**Figure 4.1 Budget Allocation of BGHMC for Covid-use Items (Oct-Dec 2020)**

Figure 4.1 aims to present the budget allocation for Covid-use items. According to the figure above, Bataan General Hospital and Medical Center allocated a large budget for Remdesivir 100mg Lyophilized Powder for Infusion w with a total budget of 3,575,000 and Favipiravir 200 mg with a total budget of 256,200 consecutively. Meanwhile, the lowest budget allocation is for Oseltamivir (as phosphate) 75 mg with a total budget allocation of ₱ 225,000. This implies that in Bataan General Hospital and Medical Center, Remdesivir 100mg Lyophilized Powder for Infusion w is highly needed for combating Covid-19 virus, thus, BGHMC allocates the highest budget for it.



**Figure 4.2 Budget Allocation of BGHMC for PCR Lab Items (Oct-Dec 2020)**

PCR (Polymerase Chain Reaction) is a test conducted to detect the presence of virus in the DNA if one is infected and shows a fragment of virus even if the person is no longer infected. Figure 4.2 depicts the budget allocated for PCR Lab items, with the Nucleic Acid Diagnostic PCR kit (FlourescenceProb) receiving the highest budget allocation of the 17 PCR lab items, this is followed by Viral RNA Extraction Kit and VTM tube consecutively. It can be inferred that the aforementioned item has the major share in Bataan General Hospital and Medical Center's budget in terms of PCR Lab items. Meanwhile, Test Tube rack 5-10 ml (Autoclavable) allocates the least budget with only ₱ 23,750 during the fourth quarter of 2020.

Summary of BGHMC's Budget Allocation for Covid Measures

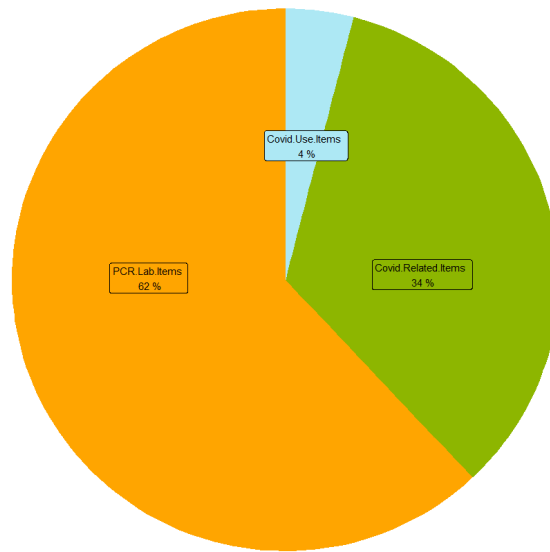


Figure 4.3 **Summary of BGHMC's Budget Allocation for Covid-19 Measures**

Figure 4.3 presents the summary of the overall budget aggregated from the three parameters of interest: covid-related, covid use, and PCR lab. The calculated amount of the entire data reached ₱167,432,350.00 wherein 64% of that value is devoted to PCR Lab items acquiring ₱106,831,150. Then, 34% belongs to the Covid-related items garnering ₱56,545,000.00. Lastly, ₱4,056,200.00 for Covid use items making its 2% portion. From these data, it can be generalized that a huge amount of budget is funded for the materials used by the Bataan General Hospital and Medical Center during the last quarter of the year 2020. It can be deduced that the fight for the pandemic is really a challenge because it requires a large amount of budget in order for people to be treated and safe from the threats of the virus.

## **CONCLUSION**

In the course of an exhaustive research, it can be deduced that in the fourth quarter of 2020, Bataan General Hospital and Medical Center allotted a significant portion of its budget resources on covid-related items, most significantly on Laboratory Supplies & Equipment and Medical Supplies & Laboratory Instrument which accounted for more than 60% of its total expenditures. This percentage was observed to be established for general use of the healthcare institution and not solely as measures to COVID-19. Furthermore, on account of procured items as part of COVID-19 measures, Polymerase Chain Reaction Kit (PCR kit) and Personal Protective Equipment (PPE) secured the major share of BGHMC's budget. In addition thereto, Disposable Surgical and N95 Face Masks as well as OR Caps topped the list in the context of items with highest number of procurement. The aforementioned items procured by BGHMC are critical in safeguarding the health and welfare of both medical personnel and patients from the adverse effects of COVID-19.

## **RECOMMENDATIONS**

This paper was driven by the objectives of analyzing and verifying the COVID-19 inclined procurement initiatives of Bataan General Hospital and Medical Center during the fourth quarter of the year 2020. However, this paper may have also exhibited deficiency on grounds of dataset selection, data preparation, and visualization. Therefore, the following are the recommendations which could be of use to future researches:

- Additional budget for Hospital or Medical Equipment Services business category of BGHMC could be proposed as healthcare institutions like hospitals cater to an increasing number of patients during the COVID-19 pandemic
- With the aforementioned findings, it is highly recommended for BGHMC to allocate additional budget for procurement of covid-use items as drugs and medicines are essential in striving against COVID-19
- It has been quite a challenge to deal with a limited quantity of data on COVID-19 in BGHMC, thus, it could be suggested for the study to explore on various datasets and conduct comparative analysis or any other similar undertaking
- It could also be ideal to work on different timelines or data which pertains to dates and periods of procurement



## REFERENCES

- Aglibot, J. R. (2021, October 2). OCTA: 3 Central Luzon provinces among areas with highest new COVID-19 cases. INQUIRER.Net.  
<https://www.google.com.ph/amp/s/newsinfo.inquirer.net/1495697/octa-3-central-luzon-provinces-among-areas-with-highest-new-covid-19-cases/amp>
- Montoya, J. E., Item, L. M., & Baltazar, G. (2021, March 1). Continuing cancer care in a religious facility: A feasible alternative in the COVID-19 Pandemic Era? PubMed Central (PMC).  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7836373/#bibl0005title>
- OCTA Research. <https://www.octaresearch.com>
- PhilGEPS. Open Data. Bid Notices and Award Notices.  
<https://notices.philgeps.gov.ph/opendataSRD.html>
- Philippine Statistics Authority. (2021, July 5). Causes of Deaths in the Philippines (Preliminary): January to December 2020. <https://psa.gov.ph/vital-statistics/id/164771>
- Philippine Statistics Authority. (2021, August 20). Causes of Deaths in the Philippines (Preliminary): January to June 2021. <https://psa.gov.ph/vital-statistics/id/165007>
- S. Talabis, D.A., Babierra, A.L., H. Buhat, C.A. et al. Local government responses for COVID-19 management in the Philippines. BMC Public Health 21, 1711 (2021).  
<https://doi.org/10.1186/s12889-021-11746-0>

## APPENDIX

### Documentation (R Source Code)

```
library("dplyr")
library("tidyverse")
library("ggplot2")
library("scales")
library("treemapify")
library("wesanderson")

#=====Filtering of the Data Set=====

#loading the raw data sets
bidding_oct_dec_2020 <- read.csv("D:\\BS AYTI 3\\1st Sem\\IT 116 Information Management
  2\\Activities\\machine_exercise_1\\Banico_IM2_3A_ME1A_Bid Notice and Award Details
  Oct-Dec 2020.csv", skip = 3)
View(bidding_oct_dec_2020)

#filtering the BATAAN GENERAL HOSPITAL AND MEDICAL CENTER as data set interest
bataan_hospital_dataset <- filter(bidding_oct_dec_2020,
  bidding_oct_dec_2020$Organization.Name == "BATAAN GENERAL HOSPITAL AND
  MEDICAL CENTER")
view(bataan_hospital_dataset)

bataan_hospital_dataset <- select(bataan_hospital_dataset, Organization.Name,
  Business.Category, Approved.Budget.of.the.Contract, Item.Name, Item.Desc, Quantity,
  Item.Budget)
bataan_hospital_dataset$Quantity <- as.numeric(bataan_hospital_dataset$Quantity)

#filtering the covid related items
covid.related <- filter(bataan_hospital_dataset, bataan_hospital_dataset$Item.Desc ==
  "COVID RELATED")
view(covid.related)

#filtering the pcr lab items
pcr.lab <- filter(bataan_hospital_dataset, bataan_hospital_dataset$Item.Desc == "PCR Lab")
view(pcr.lab)

#filtering the covid use items
covid.use <- filter(bataan_hospital_dataset, bataan_hospital_dataset$Item.Desc == "COVID
  USE")
view(covid.use)

#final filtered data set merge
covid.data <- rbind(covid.related, covid.use, pcr.lab)
view(covid.data)

#saving the clean data set to csv
write.csv(bataan_hospital_dataset, "C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
  proj\\dataset\\bataan_hospital_dataset_oct_dec_2020.csv")
```

```

write.csv(covid.related,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\covid_related_dataset_oct_dec_2020.csv")
write.csv(pcr.lab,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\pcr_lab_dataset_oct_dec_2020.csv")
write.csv(covid.use,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\covid_use_dataset_oct_dec_2020.csv")
write.csv(covid.data,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\covid_data_dataset_oct_dec_2020.csv")

#=====Visualizing the Data Set=====

options("scipen"=100, "digits"=4) #forcing R not to use exponential notation

#1. Which among the business categories receives the largest percentage of BHGMC's
approved contract budget?

#get all the unique data in a row and order it alphabetically then remove the comma
percent <- distinct(bataan_hospital_dataset, Business.Category,
  Approved.Budget.of.the.Contract)
percent <- percent[order( percent$Business.Category),]
percent$Approved.Budget.of.the.Contract <-
  as.numeric(gsub(',', '', percent$Approved.Budget.of.the.Contract))

#view(percent)

#create a new column for the percentage
percent <- percent %>% group_by(Business.Category) %>%
  summarise(Approved.Budget.of.the.Contract= sum(Approved.Budget.of.the.Contract))%>%
  mutate(perc =
    (Approved.Budget.of.the.Contract/sum(Approved.Budget.of.the.Contract)))%>%
  mutate(labels = scales::percent(perc))

#view(percent)

#arrange in ascending order the approved budget contract
percent <- percent[order( percent$Approved.Budget.of.the.Contract),]
write.csv(percent,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-proj\\dataset\\q1-BC-
percentage.csv")
budget <- paste0 (" Php ", percent$Approved.Budget.of.the.Contract)
#view(percent)

#colors of the graphs using wes_palette

col <- wes_palette("Darjeeling1", n=18, type="continuous")

#plotting the percentage of business category here using ggplot
ggplot(percent, aes(area=perc,
  fill=Business.Category,
  label=labels))+
  geom_treemap()+
  scale_fill_manual(values = col)+

```

```

labs(title=("Approved Contract Budget Percentage per Business Category of BGHMC in Oct-
Dec 2020"))+
geom_treemap_text(fontface = "bold",
  colour = "#ffffff",
  place = "centre",
  grow = FALSE)+
theme(legend.position = "bottom",
  plot.title = element_text(hjust = 0.5,
    face = "bold",
    size = 15),
  text = element_text(face = "bold",
    size = 9,
    color = "#000000"))

#plotting the ranking of the largest expenditure of business category using ggplot
ggplot(percent, aes(x = reorder(Business.Category, Approved.Budget.of.the.Contract),
  y = Approved.Budget.of.the.Contract,
  .desc = TRUE,
  fill = Business.Category))+
geom_bar(stat = "identity")+
scale_fill_manual(values = col)+
labs(title=("Approved Contract Budget per Business Category of BGHMC in Oct-Dec 2020"))+
theme(legend.position = "none",
  plot.title = element_text(hjust = 0.5,
    face = "bold",
    size = 10),
  text = element_text(face = "bold",
    size = 9,
    color = "#000000"),
  panel.border = element_blank(),
  # Remove panel grid lines
  panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(),
  # Remove panel background
  panel.background = element_blank(),
  # Add axis line
  axis.line = element_line(colour = "grey"))+
xlab("Business Category")+
ylab("Total Budget Allocation")+
geom_text(aes(label=budget),
  position=position_dodge(width=1),
  hjust=-0.1,
  vjust=0.5,
  label.padding = unit(0.25, "lines"),
  size=3)+
coord_flip()

```

#2. What are the items procured by BHGMC as measures to Covid-19 during the fourth quarter of the year 2020? (item name and Quantity)

#COVID-RELATED ITEMS

```

no2.covid.related <- covid.related %>%
  group_by(Item.Name) %>%
  summarise(Quantity= sum(Quantity))

view(no2.covid.related)

#shortening/renaming the values in the column Item.Name for easier viewing of the graph
#(COVID-RELATED)
no2.covid.related[no2.covid.related == "Critical cover with hood, (head to toe covering)] <-
  "Critical Cover with Hood"
no2.covid.related[no2.covid.related == "Disposable Surgical Mask 3 ply non woven with bact"] <-
  "Disposable Surgical Mask"
no2.covid.related[no2.covid.related == "Face shield, non fog, transparent film protected"] <-
  "Face Shield"
no2.covid.related[no2.covid.related == "Isolation gown, non woven, water repellant, free s"] <-
  "Isolation Gown"
no2.covid.related[no2.covid.related == "N95 Facemask, fluid resistant, with bacterial filt"] <-
  "N95 Face Mask"
no2.covid.related[no2.covid.related == "Nitrile Examination Gloves, non - sterile x 100's"] <-
  "Nitrile Examination Gloves"
no2.covid.related[no2.covid.related == "OR Caps, non woven, disposable, gartered"] <- "OR
  Caps"
no2.covid.related[no2.covid.related == "PPE Set Critical cover, (assorted sizes) 1 pc Isol"] <-
  "PPE Set Critical Cover"
no2.covid.related[no2.covid.related == "Rubber boots, size"] <- "Rubber Boots"
no2.covid.related[no2.covid.related == "Safety goggles closed with elastic bands"] <- "Safety
  Goggles"
no2.covid.related[no2.covid.related == "Shoe cover, plastic (50s/pack)"] <- "Shoe Cover"
no2.covid.related[no2.covid.related == "Washable gown, micro fiber, free size"] <- "Washable
  Gown"

write.csv(no2.covid.related,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
  proj\\dataset\\no2.covid.related.csv")

#plotting the most procured covid-related items
ggplot(no2.covid.related,
  aes(x = reorder(Item.Name, Quantity),
    y = Quantity,
    .desc = TRUE,
    fill = Item.Name))+
  geom_bar(stat = "identity")+
  scale_fill_manual(values = col)+
  geom_text(aes(label=Quantity),
    position=position_dodge(width=1),
    hjust=-0.1,
    vjust=0.2,
    size=3)+
  labs(title=("Procured Covid-related Items of BGHMC in Oct-Dec 2020"))+
  theme(text = element_text(face = "italic",
    size=11,
    color = "#000000"),

```

```

legend.position = "bottom",
plot.title = element_text(hjust = 0.5,
                           face = "bold",
                           size = 10),
panel.border = element_blank(),
# Remove panel grid lines
panel.grid.major = element_blank(),
panel.grid.minor = element_blank(),
# Remove panel background
panel.background = element_blank(),
# Add axis line
axis.line = element_line(colour = "grey"))+
xlab("Item Procured (Covid-related)")+
ylab("Quantity")+
scale_x_discrete(labels = label_wrap(20))+
coord_flip()

#COVID-USE ITEMS
no2.covid.use <- covid.use %>%
  group_by(Item.Name) %>%
  summarise(Quantity= sum(Quantity))
#shortening/renaming the values in the column Item.Name for easier viewing of the graph
no2.covid.use[no2.covid.use == "Favipiravir 200 mg"] <- "Favipiravir (200 mg)"
no2.covid.use[no2.covid.use == "Oseltamivir (as phosphate) 75 mg"] <- "Oseltamivir (75 mg)"
no2.covid.use[no2.covid.use == "Remdesivir 100mg Lyophilized Powder for Infusion w"] <-
  "Remdesivir (100 mg)"

write.csv(no2.covid.use,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\no2.covid.use.csv")

#plotting the most procured covid-use items
ggplot(no2.covid.use,
  aes(x = reorder(Item.Name, Quantity),
      y = Quantity,
      .desc = TRUE,
      fill = Item.Name))+
geom_bar(stat = "identity")+
geom_text(aes(label=Quantity),
  position=position_dodge(width=1),
  hjust=-0.1,
  vjust=0.2,
  size=4)+
scale_fill_manual(values = c("#ADE8F4", "#8DB600", "#FFA500"),
  labels = c("Favipiravir", "Oseltamivir", "Remdesivir"))+
labs(title=("Procured Covid-use Items of BGHMC in Oct-Dec 2020"))+
theme(text = element_text(face = "italic",
  size=12,
  color = "#000000"),
  legend.position = "bottom",
  plot.title = element_text(hjust = 0.5,
    face = "bold",

```

```

        size = 10),
    panel.border = element_blank(),
    # Remove panel grid lines
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    # Remove panel background
    panel.background = element_blank(),
    # Add axis line
    axis.line = element_line(colour = "grey"))+
xlab("Item Procured (Covid-use)")+
scale_x_discrete(labels = label_wrap(20))+
coord_flip()

#PCR LAB ITEMS
no2.pcr.lab <- pcr.lab %>%
  group_by(Item.Name) %>%
  summarise(Quantity= sum(Quantity))

#shortening/renaming the values in the column Item.Name for easier viewing of the graph
#(PCR LAB)
no2.pcr.lab[no2.pcr.lab == "1000ul Filtered tips 10x96/pack"] <- "Filtered Tips (1000 ul)"
no2.pcr.lab[no2.pcr.lab == "10ul Filtered tips 10x96/pack"] <- "Filtered Tips (10 ul)"
no2.pcr.lab[no2.pcr.lab == "200ul Filtered tips 10x96/pack"] <- "Filtered Tips (200 ul)"
no2.pcr.lab[no2.pcr.lab == "8 strip tube with cap 1.2ml low profile optically"] <- "8 Strip Tube
  with Cap (1.2 ml)"
no2.pcr.lab[no2.pcr.lab == "Biohazard Autoclavable bag(80cmx60cm)"] <- "Biohazard
  Autoclavable Bag"
no2.pcr.lab[no2.pcr.lab == "Microcentrifuge tube 1.5-2.0 ml 500/pack"] <- "Microcentrifuge
  Tube (1.5 - 2.0 ml)"
no2.pcr.lab[no2.pcr.lab == "Microcentrifuge tube rack 2.0 ml"] <- "Microcentrifuge Tube Rack
  (2.0 ml)"
no2.pcr.lab[no2.pcr.lab == "N95 Respirator and Surgical Mask 1860 (green)"] <- "N95
  Respirator and Surgical Mask"
no2.pcr.lab[no2.pcr.lab == "Nucleic Acid Diagnostic PCR kit (Flourescence Prob)"] <- "Nucleic
  Acid Diagnostic PRC Kit"
no2.pcr.lab[no2.pcr.lab == "PCR Plate low profile, unskirted, clear MLL9601"] <- "PCR Plate"
no2.pcr.lab[no2.pcr.lab == "PCR Plate Sealing film, adhesive,opticaly clear MS"] <- "PCR Plate
  Sealing Film"
no2.pcr.lab[no2.pcr.lab == "PCR tube Cooling Rack"] <- "PCR Tube Cooling Rack"
no2.pcr.lab[no2.pcr.lab == "PPE set Type A"] <- "PPE Set (Type A)"
no2.pcr.lab[no2.pcr.lab == "PPE Type B"] <- "PPE Set (Type B)"
no2.pcr.lab[no2.pcr.lab == "Test Tube rack 5-10 ml( Autoclavable)"] <- "Test Tube Rack (5 - 10
  ml)"
no2.pcr.lab[no2.pcr.lab == "Viral RNA Extraction Kit with 8 strip tip 32T/kit"] <- "Viral RNA
  Extraction Kit"
no2.pcr.lab[no2.pcr.lab == "VTM tube 3.0 ml with OPS & NPS 25's"] <- "VTM Tube (3.0 ml)"

write.csv(no2.pcr.lab,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
  proj\\dataset\\no2.pcr.lab.csv")

#plotting the most procured pcr lab items

```

```

ggplot(no2.pcr.lab, aes(x = reorder(Item.Name, Quantity),
                        y = Quantity,
                        .desc = TRUE,
                        fill = Item.Name))+
  geom_bar(stat = "identity")+
  geom_text(aes(label=Quantity),
            position=position_dodge(width=1),
            hjust=-0.2,
            vjust=0.5,
            size=3)+
  scale_fill_manual(values = col)+
  theme(text = element_text(face = "italic",
                             size=10,
                             color = "#000000"),
        legend.position = "bottom",
        plot.title = element_text(hjust = 0.5,
                                    face = "bold",
                                    size = 10),
        panel.border = element_blank(),
        # Remove panel grid lines
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        # Remove panel background
        panel.background = element_blank(),
        # Add axis line
        axis.line = element_line(colour = "grey"))+
  xlab("Item Procured (PCR Lab)")+
  ylab("Quantity")+
  labs(title=("Procured PCR Lab Items of BGHMC in Oct-Dec 2020"))+
  scale_x_discrete(labels = label_wrap(20))+
  coord_flip()

```

#### #TOP 3 MOST PROCURED ITEMS

```

top.covid.related <- top_n(covid.related, n=3, Quantity)
top.covid.use <- top_n(covid.use, n=3, Quantity)
top.pcr.lab <- top_n(pcr.lab, n=3, Quantity)

```

#### #merging

```

top3 <- rbind(top.covid.related, top.pcr.lab, top.covid.use)

```

#### #plotting

```

ggplot(top3, aes(x = reorder(Item.Name, Quantity),
                  y = Quantity,
                  .desc = TRUE))+
  geom_bar(stat = "identity",
            fill = "#166e6a")+
  facet_wrap(~ Item.Desc)+
  geom_text(aes(label=Quantity),
            position = position_dodge(width=1),
            angle = -90,
            hjust=0.5,

```



```

      vjust=-1,
      size=3)+
labs(title=("Top 3 Most Procured Items of BGHMC per Item Description in Oct-Dec 2020"))+
theme(text = element_text(face = "bold",
      size=10,
      color = "#000000"),
      plot.title = element_text(hjust = 0.5,
      face = "bold",
      size =10),
      panel.border = element_rect(color="black",
      fill=NA,
      size=1),
      # Remove panel grid lines
      panel.grid.major = element_blank(),
      panel.grid.minor = element_blank(),
      # Remove panel background
      panel.background = element_blank(),
      # Add axis line
      axis.line = element_line(colour = "black"))+
xlab("Item Procured")+
ylab("Quantity")+
scale_x_discrete(labels = label_wrap(20))+
coord_flip()

```

#3. What is the budget allocation per item procured by BHGMC as Covid-19 measures during the fourth quarter of the year 2020?

```

# covid.related conversion and filtering
covid.related$Item.Budget <- as.numeric(gsub(",","",covid.related$Item.Budget))

xample1 <- covid.related %>%
  group_by(Item.Name) %>% summarise(Item.Budget= sum(Item.Budget))
write.csv(xample1,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\xample1.csv")

# covid.related plotting
label1 <- paste0 (" Php ", xample1$Item.Budget)

ggplot(xample1, aes(x=reorder(Item.Name, Item.Budget),
      y=Item.Budget,
      fill=Item.Name))+
geom_bar(stat = "identity") +
geom_text(aes(label=label1),
      position=position_dodge(width=1),
      hjust=0,
      vjust=0.3,
      size=3)+
scale_fill_manual(values= col)+
labs(title=("Budget Allocation of BGHMC for Covid-related Items (Oct-Dec 2020))")+
theme(text = element_text(face = "italic",
      size=10,

```

```

        color = "#000000"),
legend.position = "bottom",
plot.title = element_text(hjust = 0.5,
        face = "bold",
        size = 10),
panel.border = element_blank(),
# Remove panel grid lines
panel.grid.major = element_blank(),
panel.grid.minor = element_blank(),
# Remove panel background
panel.background = element_blank(),
# Add axis line
axis.line = element_line(colour = "grey"))+
xlab("Item Procured (Covid Related)")+
ylab("Budget Allocation per Item")+
scale_x_discrete(labels=label_wrap_gen(20))+
coord_flip()

# covid.use plotting
covid.use$Item.Budget <- as.numeric(gsub(",","",covid.use$Item.Budget))

xample2<- covid.use %>%
  group_by(Item.Name) %>%
  summarise(Item.Budget= sum(Item.Budget))
write.csv(xample2,"C:\\Users\\Jeffrey Banico\\Desktop\\R\\midterm-
proj\\dataset\\xample2.csv")

label2 <- paste0 (" Php ", xample2$Item.Budget)

ggplot(xample2, aes(x=reorder(Item.Name, Item.Budget),
  y=Item.Budget,
  fill=Item.Name))+
geom_bar(stat = "identity") +
geom_text(aes(label=label2),
  position=position_dodge(width=1),
  hjust=-0.1,
  vjust=1,
  size=3)+
scale_fill_manual(values=c("#ADE8F4", "#8DB600", "#FFA500"))+
theme(text = element_text(face = "italic",
  size=12,
  color = "#000000"),
legend.position = "bottom",
plot.title = element_text(hjust = 0.5,
  face = "bold",
  size = 10),
panel.border = element_blank(),
# Remove panel grid lines
panel.grid.major = element_blank(),
panel.grid.minor = element_blank(),
# Remove panel background

```

```

    panel.background = element_blank(),
    # Add axis line
    axis.line = element_line(colour = "grey"))+
  xlab("Item Procured (Covid-Use)")+
  ylab("Budget Allocation per Item")+
  labs(title="Budget Allocation of BGHMC for Covid-use Items (Oct-Dec 2020)")+
  scale_x_discrete(labels=label_wrap_gen(20))+
  coord_flip()

#PCR.lab plotting
pcr.lab$Item.Budget <- as.numeric(gsub(" ", "", pcr.lab$Item.Budget))

xample3<- pcr.lab%>%
  group_by(Item.Name) %>%
  summarise(Item.Budget= sum(Item.Budget))
write.csv(xample3,"D:\\xample3.csv")

label3 <- paste0 (" Php ", xample3$Item.Budget)

ggplot(xample3, aes(x=reorder(Item.Name, Item.Budget),
  y=Item.Budget,
  fill=Item.Name))+
  geom_bar(stat = "identity") +
  geom_text(aes(label=label3), position=position_dodge(width=1),
    hjust=-0.1,
    vjust=0,
    size=2.5)+

  scale_fill_manual(values=col)+
  theme(text = element_text(face = "italic",
    size=8,
    color = "#000000"),
    legend.position = "bottom",
    plot.title = element_text(hjust = 0.5,
      face = "bold",
      size =10),
    panel.border = element_blank(),
    # Remove panel grid lines
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    # Remove panel background
    panel.background = element_blank(),
    # Add axis line
    axis.line = element_line(colour = "grey"))+
  xlab("Item Procured (PCR Lab)")+
  ylab("Budget Allocation per Item")+
  labs(title="Budget Allocation of BGHMC for PCR Lab Items (Oct-Dec 2020)")+
  scale_x_discrete(labels=label_wrap_gen(20))+
  coord_flip()

#total allocation budget of the BHGMC in terms of Covid related, covid use and pcr lab

```

```

#get the total budget for covid.related dataset
sum.covid.related <- xample1 %>%
  summarise(sum(xample1$Item.Budget))

#get the total budget for covid.use dataset
sum.covid.use <- xample2 %>%
  summarise(sum(xample2$Item.Budget))

#get the total budget for pcr.lab dataset
sum.pcr.lab <- xample3 %>%
  summarise(sum(xample3$Item.Budget))

#make a dataframe with the ItemDescription to be binded to the sumOfTables dataset
BudgetTotal <- data.frame(
  Item.Description= c("Covid.Related.Items", "Covid.Use.Items", "PCR.Lab.Items"))

#make a dataframe to compile all the total budget for each items
sumOfTables<- data.frame(
  c(sum.covid.related$`sum(xample1$Item.Budget)` ,
    sum.covid.use$`sum(xample2$Item.Budget)` ,
    sum.pcr.lab$`sum(xample3$Item.Budget)`))

#combine the BudgetTotal and sumOfTables dataframes
Summary <- cbind(BudgetTotal,sumOfTables)

#modify column names for proper naming standards
names(Summary) <- c("Item.Description", "Total.Budget")

#calculate the percentage for each total budget
pct <- round(100*Summary$Total.Budget/sum(Summary$Total.Budget))

#combine the calculation of the percentage to the dataframe summary
Summary <- cbind(Summary, pct)

#sorting percentage in ascending order
Summary$Item.Description <- Summary$Item.Description[order(Summary$pct)];
Summary$pct <- sort(Summary$pct)
#converting Item.Description as factor level
Summary$Item.Description.factor <- factor(Summary$Item.Description,
                                           levels = as.character(Summary$Item.Description))
#pie chart for the total budget allocation
#label for the pie chart
lbl <- paste(Summary$Item.Description.factor,"\n", paste(sep = " ", Summary$pct, "%"))

ggplot(data = Summary, aes(x = "",
                           y = -pct, fill = Item.Description.factor)) +
  geom_bar(width=2,
            stat = "identity") +
  coord_polar("y", start=0) +
  geom_label(aes(label = lbl),

```

```

    position = position_stack(vjust = 0.6),
    size=4) +
theme_void() +
theme(legend.position = "none",
      plot.title = element_text(face = "bold",hjust = 0.5, size=15))+
scale_fill_manual(values=c("#ADE8F4", "#8DB600", "#FFA500")) +
labs(title = "Summary of BGHMC's Budget Allocation for Covid Measures")

```