

Meta-analysis of Hydroxychloroquine Case Studies

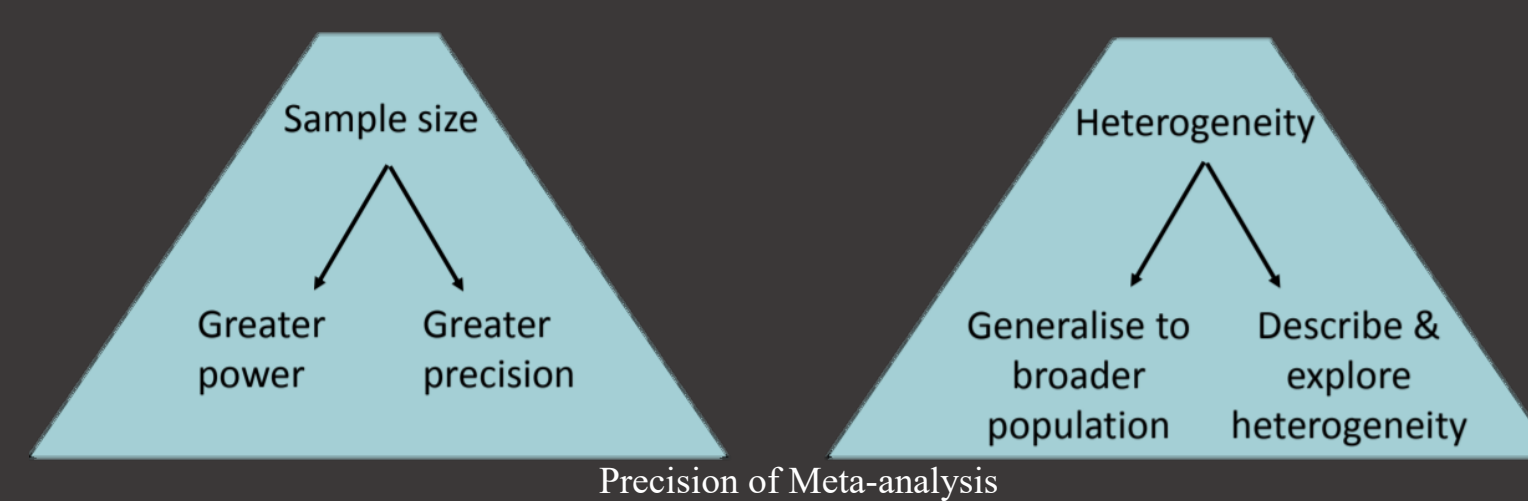
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Abstract

Summary

Hydroxychloroquine has been used to treat patients with coronavirus disease 2019 (COVID-19). However, evidence on the safety and efficacy of these therapies is limited. In effort of trying to understand the relationship between the drug and COVID-19 and clear some misinformation, this research is dedicated to find a recommendation to the public through conducting a meta-analysis. A meta-analysis is a combination of data or results from a collection of studies which address a common scientific question with less uncertainty, increased likelihood to reject a hypothesis if it is in fact false, and also including a variation in true effects (estimated heterogeneity). Using data from published case studies in the United States and medical journals from United Kingdom and France, the goal is to understand the context behind each study, identify the outliers, and give a direction based on the available information.



Remark

Having more data on hydroxychloroquine does not necessarily mean that we will know enough about its relationship with COVID-19 to decide what should we do. Because things are more complicated than just numbers, even if we have a tsunami of information, we still take a decision based on whatever we have. This, however, is the norm; everyday we make decisions with incomplete data.

Introduction

Background

Starting 2019, December of 2019, the United States has been hit with COVID-19. According to the FDA, there is no drugs approved to prevent or treat COVID-19. One drug that has been associate with this disease is hydroxychloroquine. Originally, it was approved for malaria in 1955 and has been approved for decades as a disease-modifying antirheumatic drug to treat rheumatoid arthritis (RA). Recently, this drug has been making headlines as possible treatment for the coronavirus disease (COVID-19).

Different medical labs have different results about how effective the hydroxy is. However, the drug has been extremely politized due to having our president supporting it rigorously.



Project Focus

How can we use multiple lab results about the efficacy, effectiveness and safety of hydroxychloroquine as a treatment for positive COVID-19 patients?

The main purpose is to investigate the claims several medical testing labs, having in mind the contextual information about each study and summarizing the findings into one recommendation.

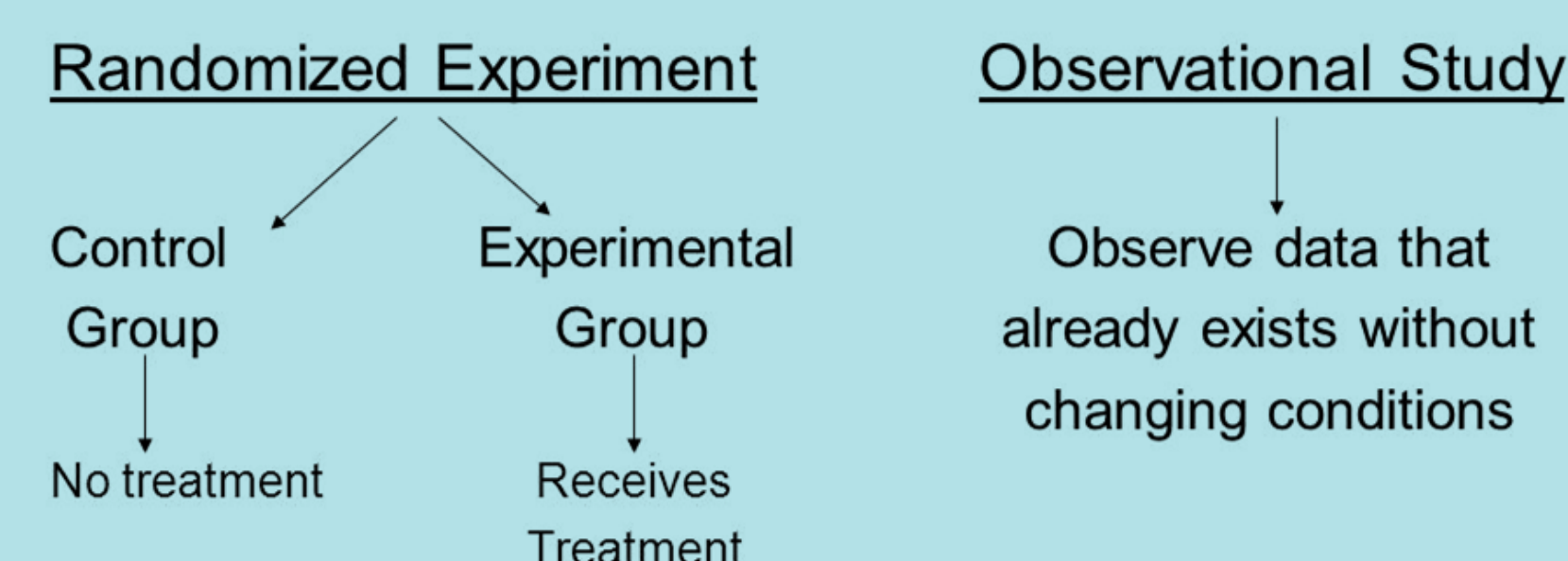
Methods

Available Data

- FDA Drug Testing Stages
- The Journal of P&E Therapeutics (Model on Mice)
- Randomized Studies:
 - Journal of the American Medical Association (Randomized Study)
 - World Health Organization Animal Study (Randomized Study)
 - R.E.C.O.V.E.R.Y. (Randomized Evaluation of COVID-19 Therapy)
- Observational Studies:
 - The New England Journal of Medicine (Observational Study)
 - U.S. Veterans Health Administration (Observational Study)
 - Henry Ford Health System (Multi-center retrospective observational study)
 - IHU-Méditerranée Infection in Marseille (Observational Study)

Observational vs Randomized Study Design

Randomized Experiment vs. Observational Study



Two Fundamental Study Designs

Randomized studies are where study participants are randomized into control and treatment groups

- **Advantages:**
 - Can draw causal conclusions on how the treatment affects the outcome
 - The gold standard of studies
- **Disadvantages:**
 - Harder to find willing participants
 - Relevantly more expensive than observational studies
 - Take more time
 - Inability to eliminate confounding variables
 - Can be unethical (to deny someone a treatment or give them something which will hurt them)

Observational studies are when researchers only collect data and do not attempt to change the behaviors of enrolled study participants (basically there is no intervention from the researchers since they are just observing the treatment)

- **Advantages:**
 - More ethical (since the researchers don't get involved in any way)
 - Cheaper
 - Conditions of the treatment are in real-life setting (not a closed experimental lab so one gets to see how things play out in action)
- **Disadvantages:**
 - Can not draw causal conclusions from the treatment and control group

Results

The French research study, named “Hydroxychloroquine plus azithromycin: a potential interest in reducing in-hospital morbidity due to COVID-19 pneumonia” actually withdrawn their manuscript and all their data claiming that “because of controversy about hydroxychloroquine and the retrospective nature of their study, we intend to revise the manuscript. We do not wish our study to be cited.”

Name	Number of Patients	Number of Patients Who Received Hydroxy	Total Number of Deaths	People who died from Hydroxy
JAMA	1438	271	292	54
The New England Journal	1376	811	346	49
R.E.C.O.V.E.R.Y.	4674	1542	1132	396
U.S. Veterans Health Administration	368	97	70	27
Henry Ford Health System	2541	1202	460	162

```
ob_vs_ran = make_array("OBS", "RAN", "RAN", "OBS", "OBS")
names = make_array("JAMA", "The New England Journal", "R.E.C.O.V.E.R.Y.", "U.S. Veterans Health Administration", "Henry Ford Health System")
patients = make_array(1438, 1376, 1542+1132, 368, 2541)
num_deaths = make_array(292, 346, 396+736, 27+25+18, 460)
people_who_took_hydroxy = make_array(271, 811, 1542, 97, 1202)
death_of_hydroxy = make_array(54, 49, 396, 27, 162)
x = Table().with columns(
  "Name", names,
  "Design", ob_vs_ran,
  "# patients", patients,
  "# HCQS Group", people_who_took_hydroxy,
  "Total Deaths", num_deaths,
  "Deaths HCQS Group", death_of_hydroxy)
x
propHCQS = people_who_took_hydroxy / patients
propHCQS_deaths = death_of_hydroxy / num_deaths
plt.plot(np.arange(0, 0.7, 0.1), np.arange(0, 0.7, 0.1), "w")
plt.scatter(propHCQS, propHCQS_deaths, c = ["b", "r", "r", "b", "b"])
plt.xlabel("Proportion Who Received HCQS")
plt.ylabel("Proportion of HCQS Deaths")
```

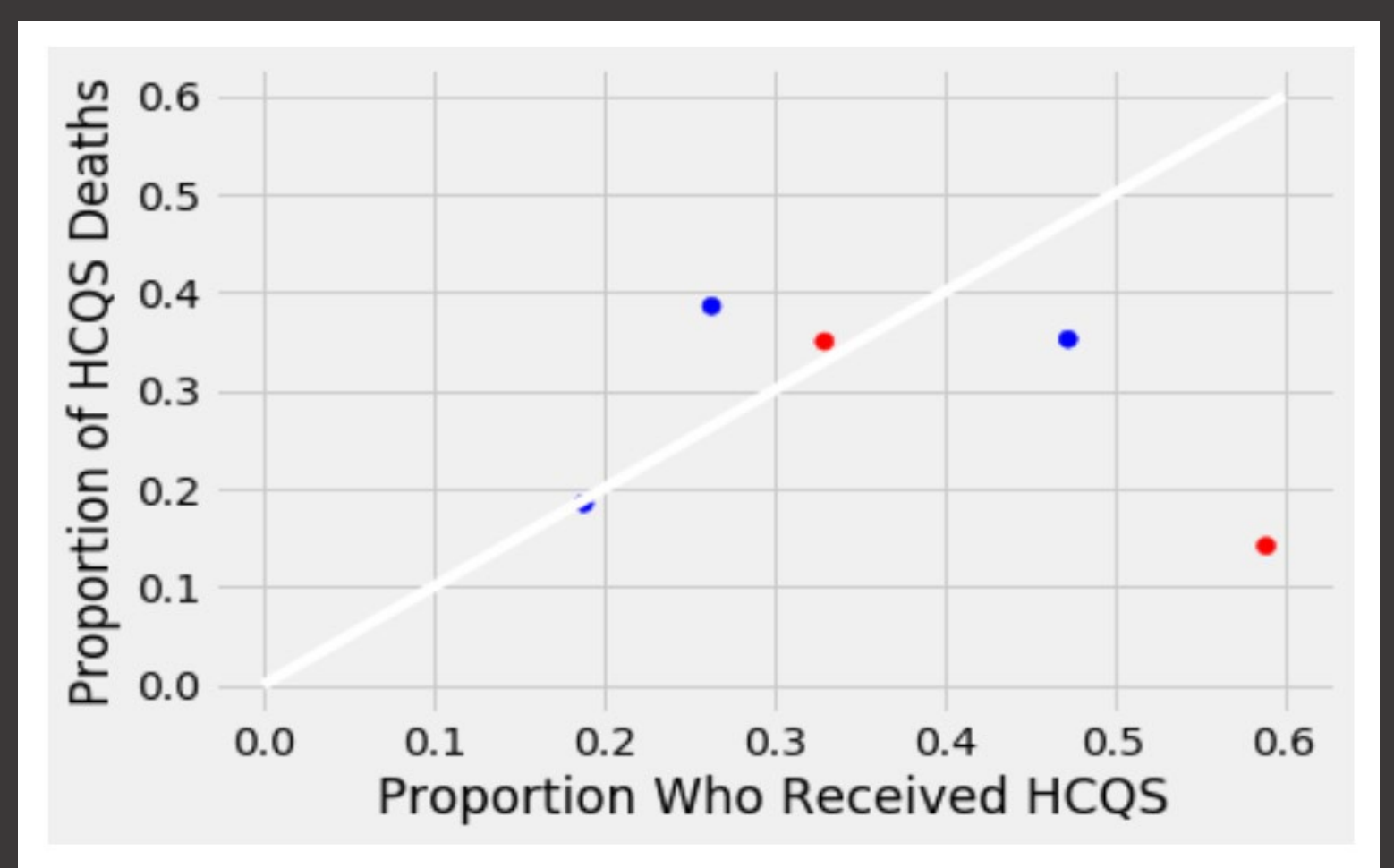
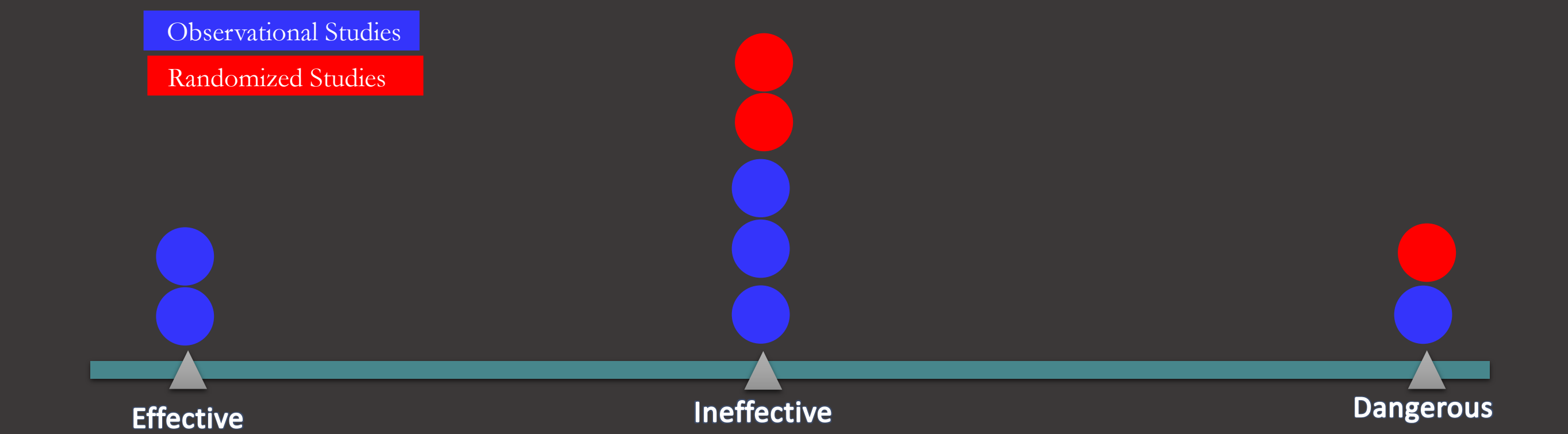


Table and graph expressing the proportion of patients vs. deaths of patients who received HCQS



Conclusion

Recommendation: After looking at all these studies, one conclusion is that hydroxychloroquine is ineffective of its treatment with COVID-19 patients, but it can be potentially dangerous with patients who has respiratory and cardiac problems.

Acknowledgments



Thank You

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References

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