Hydroxychloroquine in Patients with COVID-19 (Chen et al., 2020): Absence of Evidence, Not Evidence of Absence

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Abstract: A recent trial assessed the efficacy of hydroxychloroquine (HCQ) in the treatment of patients with common coronavirus disease-19 (COVID-19).¹ The results showed that “On day 7, COVID-19 nucleic acid of throat swabs was negative in 13 (86.7%) cases [of out 15] in the HCQ group and 14 (93.3%) cases [out of 15] in the control group ($P > 0.05$). Here we present a Bayesian reanalysis of the data, showing that the data under consideration neither undercut nor support the HCQ hypothesis in a compelling fashion. One of the reasons for this lack of diagnosticity is that both the HCQ group and the control group showed high recovery rates. In line with the authors’ conclusion, more data are needed to draw definite conclusions.

A recent trial assessed the efficacy of hydroxychloroquine (HCQ) in the treatment of patients with common coronavirus disease-19 (COVID-19).¹ The results showed that “On day 7, COVID-19 nucleic acid of throat swabs was negative in 13 (86.7%) cases [of out 15] in the HCQ group and 14 (93.3%) cases [out of 15] in the control group ($P>0.05$).” The authors concluded: “The prognosis of common COVID-19 patients is good. Larger sample size study are needed to investigate the effects of HCQ in the treatment of COVID-19”.

This conclusion leaves unaddressed the degree to which the data undercut or support the hypothesis that HCQ is (in)effective. To quantify such evidence we conducted Bayesian logistic regression.^{2,3} Under the no-effect model H_0 , the log odds ratio equals $\psi=0$, whereas under the positive-effect model H_+ , ψ is assigned a positive-only normal prior $N_+(\mu, \sigma)$. A default analysis (i.e., $\mu=0, \sigma=1$) reveals weak⁴ evidence for H_0 : the data are 1.8 times more likely under the hypothesis that HCQ is ineffective than under the hypothesis that it is beneficial. Figure 1 shows the evidence is weak for all combinations of μ in $[0, 0.30]$ and σ in $[0.1, 1]$.

Figure 1. Across a range of different priors, the evidence for no-effect H_0 over positive-effect H_+ is weak.

In addition to hypothesis testing one may also inspect the posterior distribution for ψ under a two-sided model that assigns ψ a standard normal distribution. As Figure 2 shows, the posterior distribution is relatively wide and displays only a modest change from the prior distribution, reinforcing the conclusion that the data are not diagnostic.

Figure 2. The posterior distribution for the log odds ratio is relatively wide, signifying a lack of certainty regarding the strength of the treatment effect (assuming it is present).

In sum, the data under consideration neither undercut nor support the HCQ hypothesis in a compelling fashion. One of the reasons for this lack of diagnosticity is that both the HCQ group and the control group showed high recovery rates. In line with the authors' conclusion, more data are needed to draw definite conclusions.

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