

Malaria Molecular Surveillance Study

Design Workshop

Module 7: Designing a study for multiple end-points

What do we mean by multiple end-points?



We are often interested in designing our study to test **more than one** outcome

In MMS, our sequencing panels often capture genetic information on **many molecular markers**

E.g. *pfhrp2* gene deletions + drug resistance markers

How do we design and power our study?

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Sample size* = **32 samples**

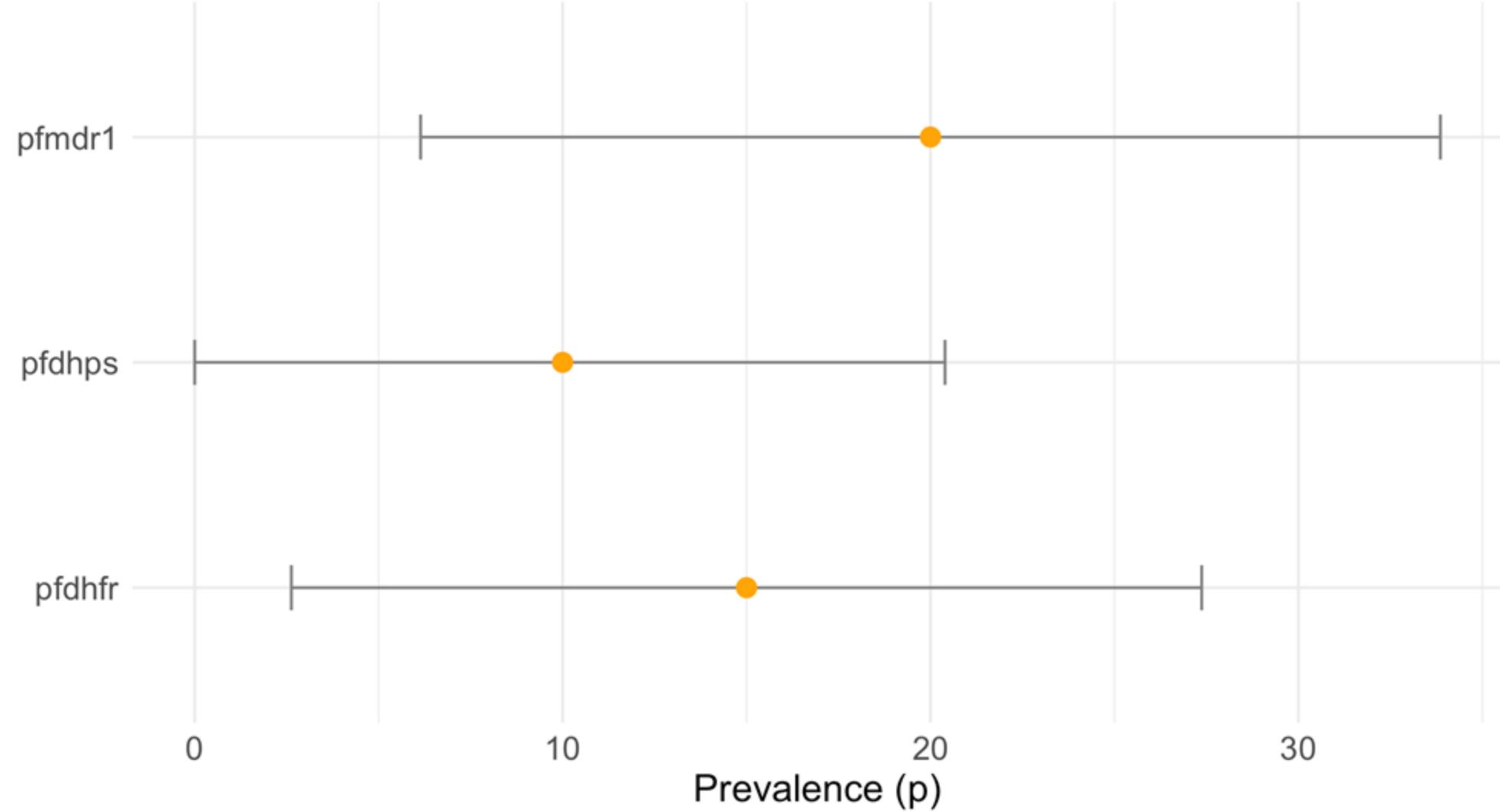
*We can use *DRpower get_sample_size_presence()*

We have now collected data from our **32 samples**, but we also want to estimate the prevalence of other drug resistance markers.

Based on expert knowledge, we suspect many of these markers are at **high prevalence**.

Drug resistance marker	Assumed prevalence (p)
<i>pfdhps</i>	0.10 (10%)
<i>pfdhfr</i>	0.15 (15%)
<i>pfdhfr</i>	0.2 (20%)

High margin of error (CIs)



Designing studies for multiple end-points



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1. Specify your **primary vs. secondary** endpoints **before** conducting the study
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2. Conduct power analysis and sample size calculation for all primary endpoints. **Take the largest value**
 - This will ensure that you have sufficient power and sample size over all endpoints!
3. You don't have to be powered to detect everything!
 - It's OK if some things are estimated with low power or precision (eg secondary end-points). They can still act as pilot data to guide future studies.

Going back to our worked example



We design our study to have **two primary end-points**:

1. Detect rare *pfk13* variant mutations (assuming 5% prevalence)
2. Estimate prevalence of *pfdhps* mutation (assuming 10% prevalence)

What steps do we need to take?

Power analysis for both end-points



Calculate minimum sample size required for both end-points (80% power)

- Detection of *pfk13* mutation (assumed prevalence 5%)

Sample size = **32 samples**

- Estimation of *pfdhps* mutation prevalence (assumed prevalence 10%)

Sample size* = **139 samples**

*We can use *DRpower get_sample_size_margin()*

Which sample size do you choose?

Choose the largest sample size!



We choose 139 as our target sample size (to estimate prevalence of *pfdmr1*)
but we are now **over-powered** for detection of *pfk13* rare mutations

Let's revisit our analysis now....

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Let's revisit our analysis now....

We are now powered to detect a prevalence of **2% rather than 5%**
... and 75% powered to detect a **1% prevalence!**

Choose the largest sample size!



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but we are now **over-powered** for detection of *pfk13* rare mutations

Let's revisit our analysis now....

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... and 75% powered to detect a **1% prevalence!**

There is interplay between the different power analyses for our various primary endpoints. As always, we are looking to **strike a balance between what is feasible and what provides the most useful information**

- Studies with multiple end-points are common and **it is important to specify our primary end-points *before* conducting our study**
- We power for our primary end-points and **always select the largest sample size**
- We always need to **balance power vs feasibility** of target sample sizes (eg we don't have to be powered to detect *everything* - pilot data is still **useful!**)

Format: Scenario-based role-play

- Work in groups. Each person given a specific role
- Together, you will design a multi-cluster study for multiple end-points
- You will need to trade off design choices – there is no one right answer!
- Present your design back to the group



[Workshop materials](#)

https://mrc-ide.github.io/MMS-SD_workshop/