Basket, umbrella and platform trials: a regulatory perspective

Julia Saperia
PSI webinar – 18th April 2018
Acknowledgments

David Brown (MHRA, BSWP)
Olivier Collignon (LIH, BSWP, EMA)
Anja Schiel (NoMA, BSWP)
And based on considerations from the Biostatistics Working Party task-force looking at these designs (Christian Gartner, David Brown, Bettina Haidich, Benjamin Hofner, Martin Posch, Olivier Collignon, Frank Pétavy, Inês Antunes Reis and Anja Schiel).

Any opinions expressed are my own and do not necessarily reflect those of the MHRA or the EMA.
The regulator’s viewpoint

Companies and consortia are

• seeking scientific advice
• making clinical trial applications
The regulator’s viewpoint

Type I error control
Selection of biomarkers
Assay sensitivity/specificity
Internal and external validation of biomarkers
The role of historical controls
Information derived from external trials that can impact the conduct of the trial
Randomised vs single arm trials
The regulator’s viewpoint

*Type I error control*
Selection of biomarkers
Assay sensitivity/specificity
Internal and external validation of biomarkers
The role of historical controls
Information derived from external trials that can impact the conduct of the trial
Randomised vs single arm trials
The first problem: terminology

Do we have a clear concept on the different trial designs?

- Appears to be a lack of common terminology

How can we address the lack of common terminology?

- Define the **trial design elements** rather than put a label on the design (FDA)
Terminology
## Terminology

### Table 1. Types of Master Protocols.

<table>
<thead>
<tr>
<th>Type of Trial</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umbrella</td>
<td>To study multiple targeted therapies in the context of a single disease</td>
</tr>
<tr>
<td>Basket</td>
<td>To study a single targeted therapy in the context of multiple diseases or disease subtypes</td>
</tr>
<tr>
<td>Platform</td>
<td>To study multiple targeted therapies in the context of a single disease in a perpetual manner, with therapies allowed to enter or leave the platform on the basis of a decision algorithm</td>
</tr>
</tbody>
</table>
**Umbrella trial**

- Single disease
  - Screen for presence of targets
    - Biomarker 1—positive
      - Targeted therapy 1
    - Biomarker 2—positive
      - Targeted therapy 2
    - Biomarker 3—positive
      - Targeted therapy 3
  - Single group or assigned according to group

**Basket trial**

- Disease or histologic feature 1
  - Screen for presence of target
    - Target-positive participants
      - Trial of one targeted therapy (controlled or uncontrolled)
  - Disease or histologic feature 2
  - Disease or histologic feature 3
Statistical controversies in clinical research: basket trials, umbrella trials, and other master protocols: a review and examples

L. A. Renfro* and D. J. Sargent

Division of Biomedical Statistics and Informatics, Mayo Clinic, Rochester, USA
Adaptive Design for a Confirmatory Basket Trial in Multiple Tumor Types Based on a Putative Predictive Biomarker

RA Beckman¹, Z Antonijevic², R Kalamegham³,⁵ and C Chen⁴
UMBRELLA DESIGN

- Multiple Drugs
- One Indication e.g. lung
- Multiple Alterations

BASKET/BUCKET DESIGN

- One Drug
- Multiple Indications e.g. lung, breast, colon...
- One Alteration
Let’s try to simplify things.
Basket trial

Target population 1

Target population 2

Target population ...

Target population N
Basket trial

- Drug D investigated in different target populations.
- Not different from a company pipeline where drug D would successively and independently be submitted to regulators for marketing authorisation in different indications.
- Provided the studies corresponding to the different target populations are independent, no multiplicity adjustment would be required.
- Of note, if for each target population the design is randomised, the same comparator might not be used since standard of care might be different.
Advantages

Molecular analyses done more efficiently and consistently within a single trial than if there were several trials, one for each (e.g) tumour type.

Exploiting expected correlation between arms could make trials more efficient – certainly true in phase 2 where separate baskets are sometimes combined

General operational efficiency of only having one protocol etc.
Umbrella Trial

Target population P

Target population P

Target population P

Target population P

Drug 1

Drug 2

Drug ...

Drug N

The target population P can be the same for each drug
Umbrella trial

In the ‘Umbrella’ trial, in each target population a different drug is tested.

This situation is not really different from a company pipeline in which portfolio drugs would successively and independently be submitted to regulators for marketing authorisation. Provided the studies corresponding to the different target populations are independent, no multiplicity adjustment would be required.

Of note if the target population is the same for each drug 1,…,N tested, and if the corresponding designs are randomized, the comparator could be the same.
Advantages

Patients come in and are classified (biomarker) and then can be immediately enrolled in the appropriate sub-study. Operationally there are some big advantages – don’t have to re-screen patients several times for biomarkers to enrol into 4 separate trials.
A recent example (anonymised) basket/umbrella

Patients with certain type of tumour with 2 different markers (A and B) + Inclusion/exclusion criteria

- Patients with marker A
  - Stratification factors: 1, 2 and 3
  - Cohort A
  - Randomisation 2:1
  - Standard of care + Study drug
  - Standard of care + Placebo

- Patients with marker B
  - Stratification factors: 1, 2 and 3
  - Cohort B
  - Randomisation 2:1
  - Standard of care + Study drug
  - Standard of care + Placebo

Disease progression

Post treatment follow-up
- Survival
- PROs
- New anti-cancer therapy + outcome

Post treatment follow-up
- Survival
- PROs
- New anti-cancer therapy + outcome
Why is this different from a subgroup analysis?

In a standard setting, the target population is the overall trial sample. The main analysis is based on a test of the primary endpoint for which some alpha is spent.
Depending then on the subgroup strategy, some alpha is devoted to the testing of the primary endpoint in each subgroup investigated.

Subgroup 1

Subgroup 2

Subgroup ...

Subgroup N
Basket trials shouldn’t be a strategy for avoiding spending some alpha to investigate the effect of the drug in different subgroups (which play the role of the target populations).
If there is no strong clinical rationale for analysing the target populations separately, a standard trial with an appropriate subgroup analysis (corresponding to the planned target populations) might be more suitable.

Pooling shouldn’t be used to rescue failed independent trials (corresponding to the target populations) on the grounds of gaining power, especially if there is a strong clinical rationale for investigating them separately.
Pooling

- Pooling is often presented as one of the advantages of multi-arm, multi-drug trials (particularly for basket trials)
- What is the planned pooling strategy? Need for pre specification (cherry picking must be avoided)
- If a ‘vast majority’ of the sub-trials corresponding to the different target populations are positive, can a global indication be obtained and how? (this will depend on the unit of observation)
- What is the intended ‘indication’?
- Can pooling be clinically justified?
- Impact of the heterogeneity of the different pooled populations (risk of failure due to pooling)
Shared control

- A single sub-study could have a control group plus more than one experimental agent
- Sometimes the agents aren’t from the same company
  - Multiplicity issue here?
- But how different is this really to two separate trials – especially if it is two separate companies?
Platform trials

- Target population 1
- Target population ...
- Target population N

Time:
- Drug 1,1
- Drug 1,2
- Drug 3,1

Drugs:
- Drug ...
- Drug N
Platform trials

- In the **same target populations**, several drugs can be analysed concurrently by **randomising** corresponding patients to different treatment arms. Also, some additional treatment arms can be added dynamically to the design.

- By definition, according to Renfro, **another target population** could also be added to the platform trial. Again, provided the corresponding trial is planned independently of the others, this should not lead to any multiplicity issues.

- Not really different from an umbrella trial provided all the trials corresponding to the target populations are **independent with their own type 1 error**.
Platform design

This approach essentially no different in terms of data generated than would be obtained from running several similar studies.

Operationally there are some big advantages – don’t have to re-screen patients several times for biomarkers to enroll into 4 separate trials.

Some statisticians concerned about error control

Issues from a CTA perspective
Multi-arm, multi-stage platform

**Shared control**

New interventions introduced and discontinued
Patients randomised between all currently available interventions and control

Control patients used in several comparisons – all that they were eligible for randomisation to.

Different endpoints can be used at interim and final analysis
Multi-arm, multi-stage platform

Clear gains in operational efficiency

Are these ‘infinite trials’? CTA issues.

Type I error control issues still under discussion

New ‘5%’ for each comparison – or need to adjust for multiplicity?

Is adjustment even possible without being able to predict the future.
Are there multiplicity issues?

The BSWP working hypothesis is:

• If we are looking at several independent trials all controlled for type 1 error relative to their own design, then no, we see no issues with multiplicity.

• Possible violation of independence (still being debated):
  • no overlap of patients (e.g: no switching from one sub-trial to the other?)
  • no overlap of treatment (e.g: no common control arm)
  • no decision taken for one trial can impact the other ones (e.g. early stop for efficacy)
  • the only common points boil down to logistical/ethical/legal aspects
• If the same studies were presented as a development pipeline we wouldn’t expect to see the type I error controlled across target populations.
Are there multiplicity issues?

Less clear the more complex the designs get

- Adding arms and/or drugs in time might cause problems with the concept of independence
- How many drugs can we test in the same indication or target population before we have a lucky hit?
- Dropping arms/drugs/target populations might not always be acceptable
- What is acceptable in the exploratory setting is not per se acceptable in the confirmatory setting
Clear … as mud.