

Science and research



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South African Medical Research Council

BUILDING A HEALTHY NATION THROUGH RESEARCH





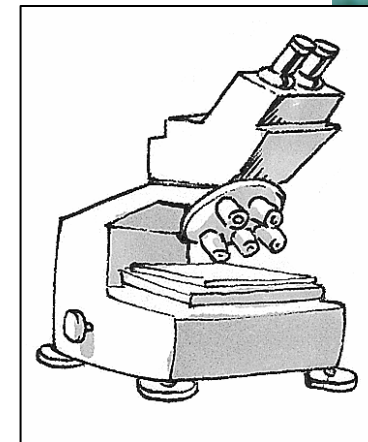
What is science and research?

- To understand HIV vaccine research, we must first understand what is science & research.
- We all look for knowledge & information to understand the world.
 - what is happening, why does it happen, what is the solution?
- Science = observation, identification, description, experimentation & theories to explain what we observe.
- Research = scholarly or scientific investigation of something.
- *Scientific research is research using the scientific method.*
- Leads to the most reliable & accurate knowledge about the world.



How is science and technology linked?

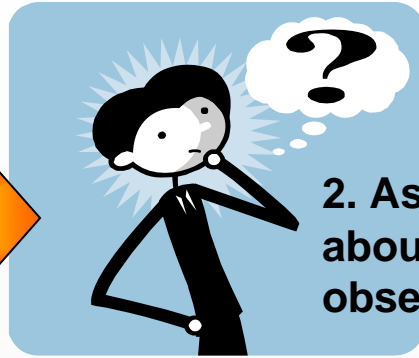
- Technology = the practical application of scientific knowledge in industry & everyday life.
- An example is:
 - the flu vaccine
 - based on knowledge gained in research
 - used in clinics to prevent influenza.



The Modern Scientific Method



1. **Observation** : observe it. Does it happen again ?

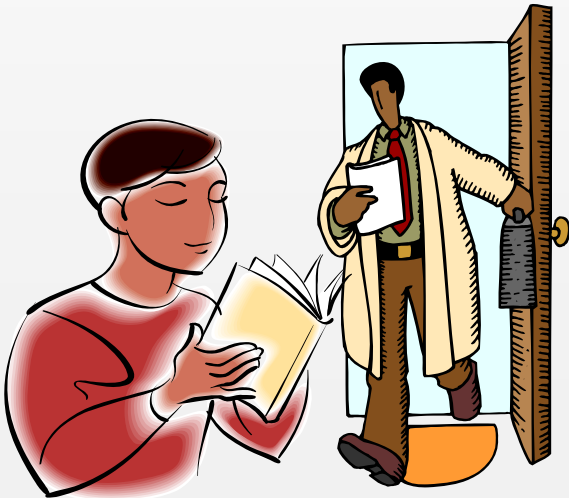


2. Ask a **question** about what they have observed

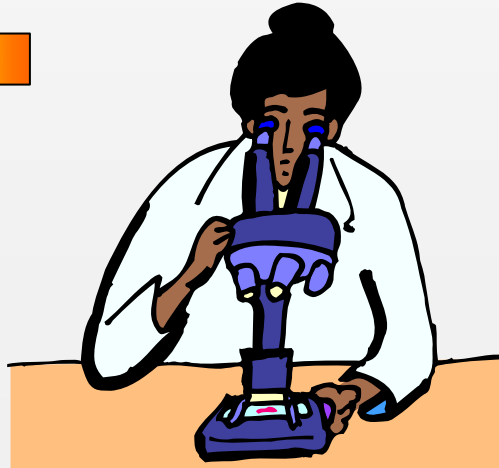


3. **Hypothesis** : suggests a reason for what they have observed

5. Other scientists repeat the experiment to **check the findings**. Scientists do other experiments to **find out more**



6. **Communicate** the results – journals, talks – so that other scientists can check the work



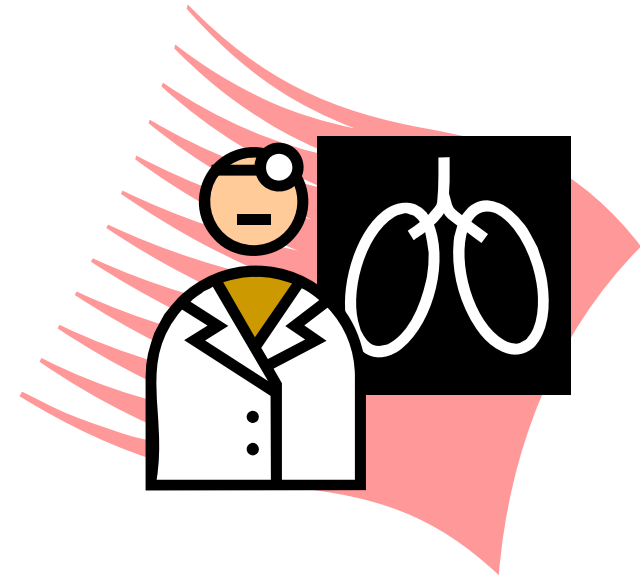
4. **Experiment** – to see if the hypothesis is true **confirm** or **reject** hypothesis



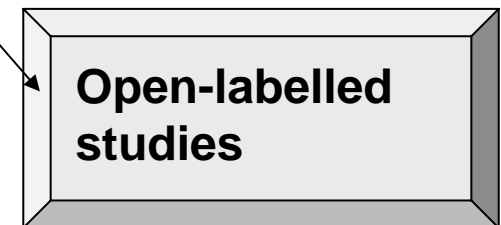
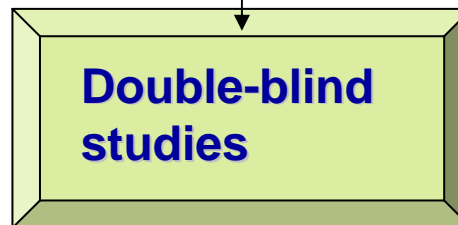
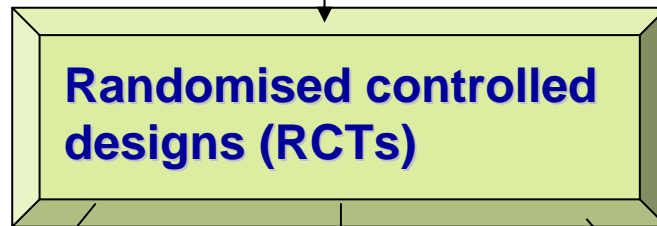
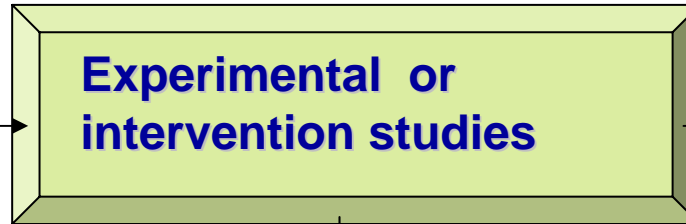
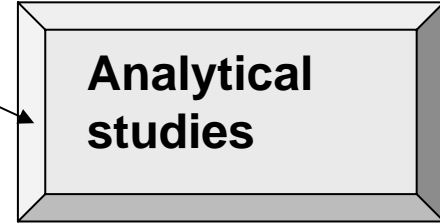
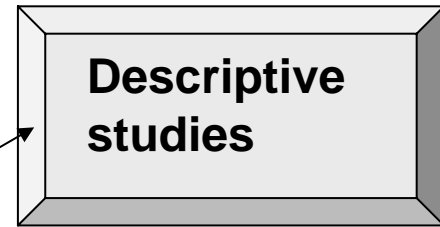


What is clinical research?

- Scientific research in humans
- Part of health research
- Answers questions & aims to solve problems in human health
- Must be done in an ethical & accurate way



Clinical research designs





Observational studies

- Descriptive:
 - no hypothesis
 - describes facts, answers questions about a health problem.
 - e.g. how big is the problem of HIV in South Africa
 - how many cases, who it affects etc.
- Analytical:
 - hypothesis
 - compare 2 groups of people
 - is there a link between an outcome & specific risk or protective factors
 - *Are there more cases of lung disease (outcome) in people who smoke than in people who do not smoke? (smoking is the risk factor.).*



Experimental or intervention studies

- Study effect of an intervention on a health problem
 - e.g. does a drug reduce someone's asthma
- Controlled environment
- Different intervention study designs
- **Randomized control trial (RCT)** design is the best.
 - open labelled
 - single-blind
 - double-blind

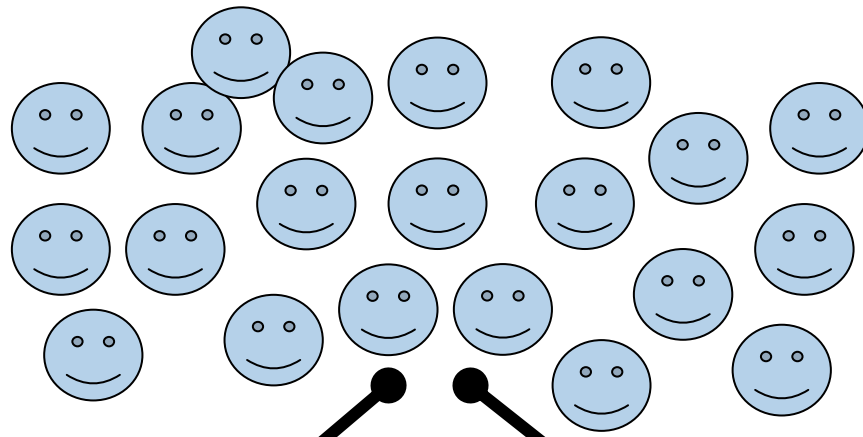




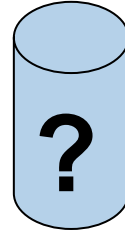
Randomisation



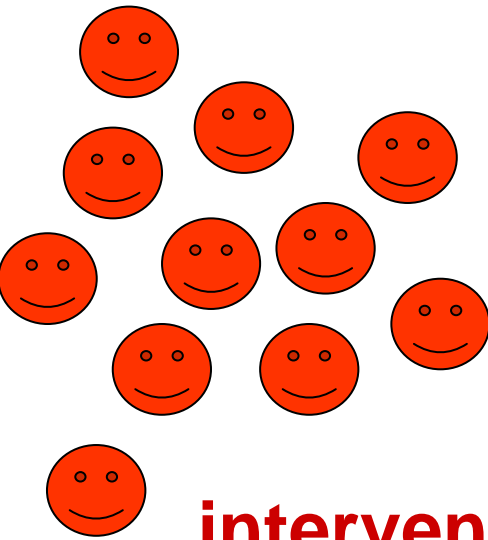
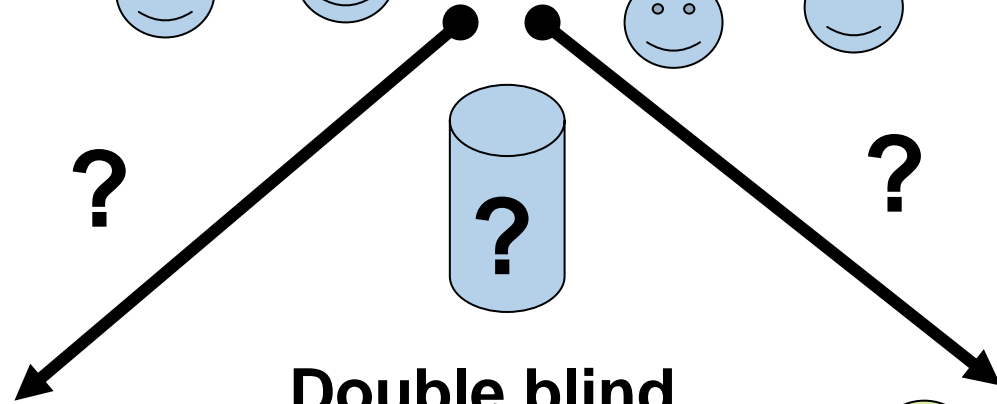
CLINICAL TRIAL



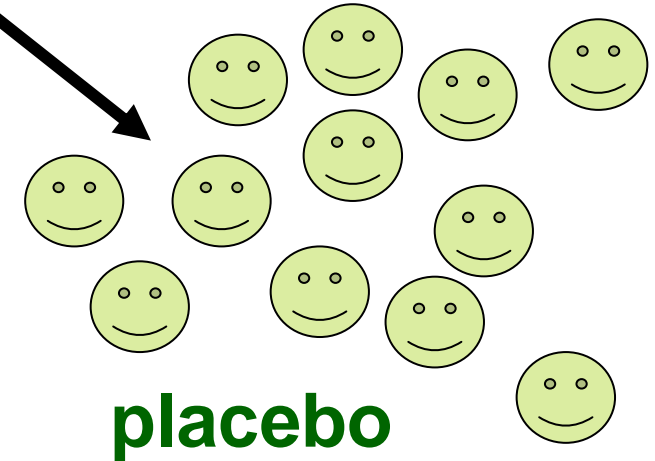
Sample size



Double blind



intervention



placebo



Randomised, double-blind, placebo-controlled design



What is a placebo?

- Looks like intervention
- Does not have active ingredient
- Causes no action on the body
- Only used if no effective drug or vaccine for the health problem being studied.
- Best in a double blind study to avoid 'researcher or participant bias'.



Drug/vaccine

Placebo



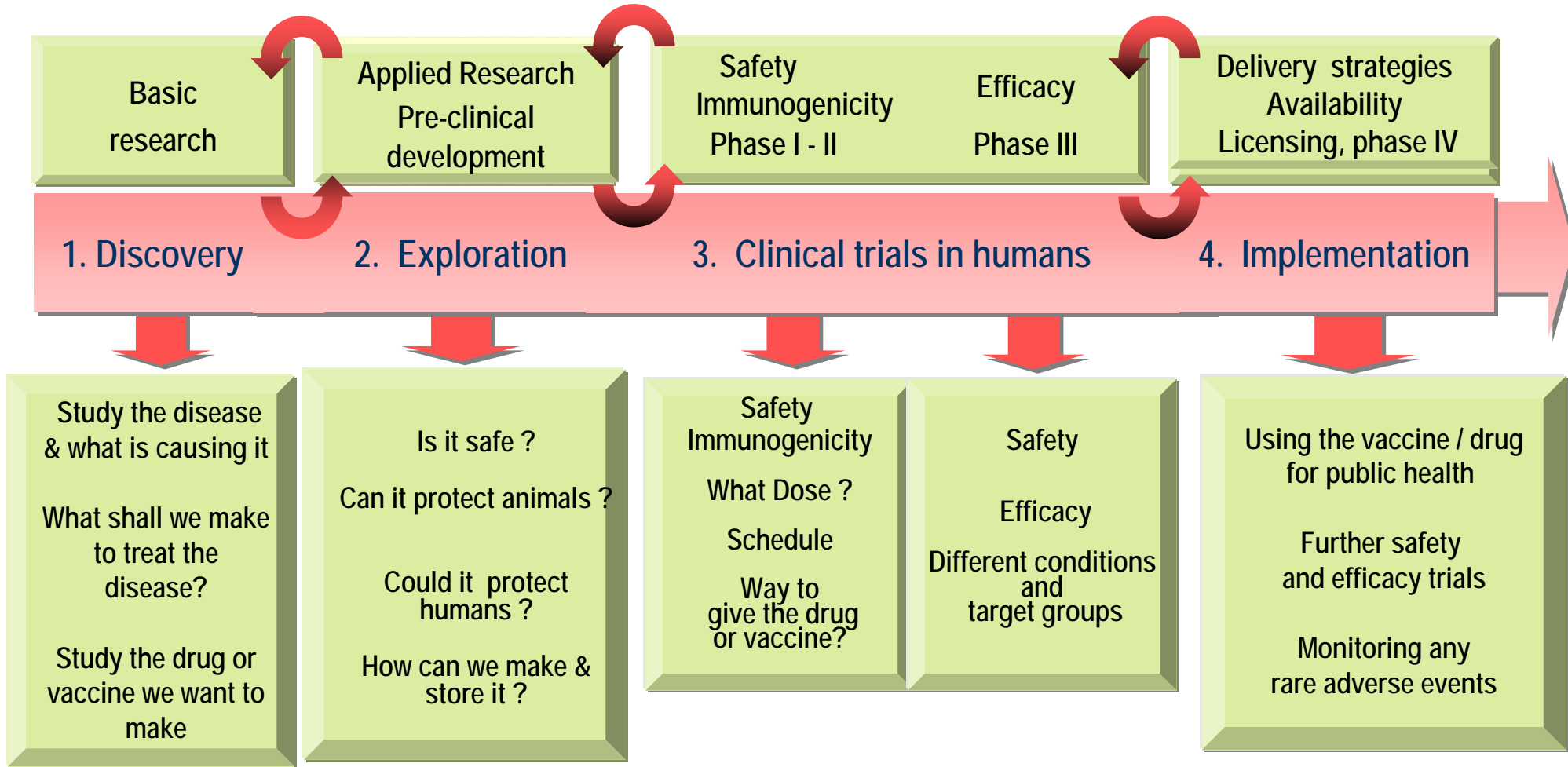
Why is sample size important?

- Sample = group of people who take part in the research
- *Sample size: number of people in the group*
 - e.g. 100 people in a study: sample size = 100.
- Researchers must work out a sample size so results are not by chance:
 - e.g. a sample size of 20 vs. 200.
- A big enough sample size means results can be applied to a broader population.
 - e.g. using results from the SA antenatal survey on HIV infections to estimate how many South Africans have HIV.

Stages of product development



Building a healthy nation through research



Stage 1: Discovery: Basic research & development in the laboratory.

Stage 2: Exploration: Studies in non-human/animal studies.

Stage 3: Clinical studies in humans.

Stage 4: Public implementation: Licensure and large-scale manufacture, followed by phase IV studies. Phase IV studies are also called post-licensure or field studies.

**Stage 1 & 2
= Pre-clinical studies.**



Stage 1:
Discovery



Stage 2:
Exploration



Stage 3: Clinical trials



Stage 4: Licensure



Phase	Testing for	Sample size & time
I	Mainly safety, (and immune responses).	40-120 Usually 12-18 months
II	Still safety, dose, how the product should be given, how often, & to start to see if it causes a response.	100s per trial Usually 1-2 years
III	Efficacy (does it work to prevent or treat the disease?). Always safety.	1000s per trial Several years
IV (field studies)	Success in real-life conditions. Impact on public & community health. Very rare adverse events.	General public Long-term, ongoing

The research protocol



Building a healthy nation through research

- A detailed plan of steps & procedures for the research
- Sponsor sends it to the regulatory authority, e.g. MCC, & RECs, to review & approve.
- To ensure research is scientifically & ethically acceptable.
- Includes, e.g.:
 - Title & purpose of research
 - Contact details of Sponsor, Monitor & Investigators
 - Research design e.g. RCT
 - Describes the intervention
 - Safety results from previous studies
 - Ethical issues





What is Good Clinical Practice (GCP)

- Minimum standards/requirements to be followed in a clinical trial.
- In SA, we apply *The Guidelines for Good Practice in the Conduct of Clinical Trials in Human Participants in South Africa, Clinical Trials Guidelines 2000*.
- Other laws & guidelines for SA are:
 - The Constitution
 - The National Health Act (2003)
 - The DoH Guidelines: *Ethics in Health Research: Principles, Structures and Processes* (2004)
- *MRC Guidelines on Ethics for Medical Research (2002)* for MRC research.

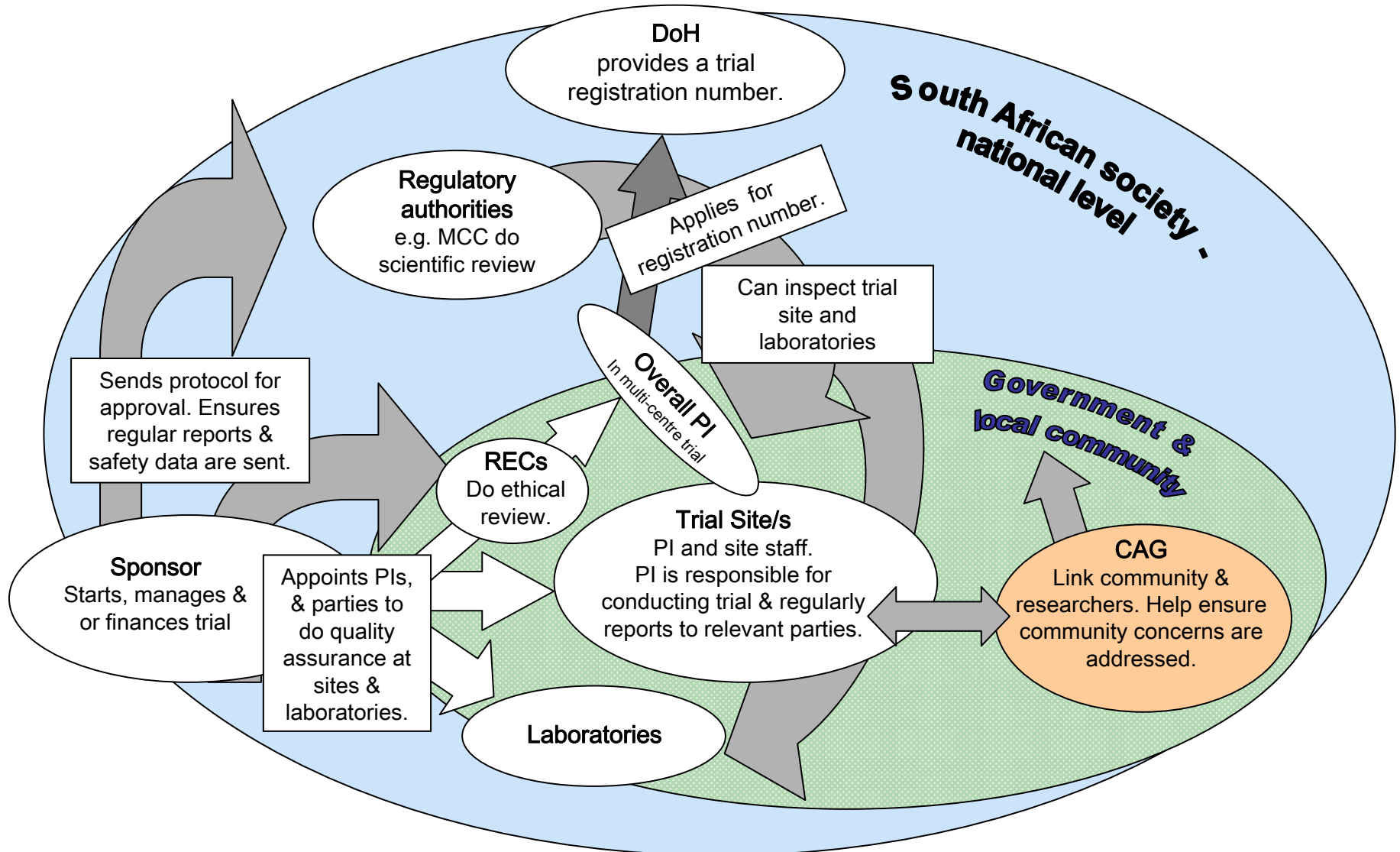


Parties involved in clinical trials

Approval	Running	Quality Assurance
Sponsor	Sponsor	Sponsor
Regulatory Authorities, e.g. MCC	Regulatory Authorities	Regulatory Authorities
Research Ethics Committee/s	RECs	RECs
Department of Health	<u>Trial site staff:</u> PI, trial site co-ordinator, doctors, nurses, counsellors, laboratory technicians, administrative staff, community outreach team, etc.	Monitor
		Auditor
		Independent Data-Monitoring Committee (IDMC) or Data and Safety Monitoring Board (DSMB)
		Community Advisory Group/Board (CAG/B)

Parties involved

Building a healthy nation through research





Why women should be included in trials

- To benefit from the findings.
- If excluded, the new knowledge might not benefit them:
 - e.g. we won't know if the drug works for women & they may not be able to use it.
- Discrimination to exclude pregnant women from relevant research:
 - but inform them about risks & benefits of the research to them & their child.
- Researchers should:
 - not do a pregnancy test on women without their permission – abuses their rights.
 - inform women they can leave the trial if they fall pregnant or at any time.
- Women should be part of the trial site staff.