At the end of this lecture you should be able to:

• describe the four main elements in a study published in a medical journal.
• outline the most common study designs.
• describe important elements of a study that should be included in a paragraph-long study summary.
• define key words used when describing a study.

Note: you will want to bring the study indicated on this date in the PHARM 309 home page, and a pencil and highlighter. What we will do is go over each of the elements of a study as outlined on the next two pages, specifically in this study. You will want to make notes in the paper as we go through it.

There are four main parts to all studies reported in medical journals. These are:

• Introduction
• Methods
• Results
• Discussion

The abstract, although a part of the journal article, merely overviews information found in the rest of the journal article. The abstract is thus not considered one of the “main” parts of a study.

What should you find in each part of the study? Some people use the acronym “IMRaD” to describe the parts of a study.

**Introduction.**

• The introduction should provide the purpose of the study and convince you of the reason that the study is needed (i.e., why it is important and unique). The introduction should help you summarize the purpose of the study, which you will explain in your first sentence.
• You will often find interesting epidemiology and pathophysiology information in the introduction.

**Methods.** There are several parts to the methods.

• Design. The investigators need to clearly describe the general design of the study. You will describe the design in the first sentence of your paragraph.
• Setting. This tells you where, geographically, the study took place.
• Subjects. The investigators will tell you about the *sample population*, that group of potential subjects available to the investigators from which the study subjects were chosen. Investigators try to choose the best patients to include in the study by using *inclusion and exclusion criteria*. Inclusion criteria describe desired characteristics people needed to have in order to be in the study. Exclusion criteria describe characteristics that would eliminate people from the study. Once patients meet inclusion criteria and give informed consent, they
become part of the sample. You will describe the number of patients and important inclusion characteristics in your first or second sentence.

- **Description of the intervention or measurements.** The intervention includes subject allocation to treatment group, a complete description of the treatment regimens, and what follow-up was done to collect risk factor and event data. If subjects are randomized to treatment, it should be noted here. The authors should also denote blinding methods. The methods that the authors used to obtain their data points should be explicitly outlined so that if carefully read and copied, readers could duplicate the results of the trial. There should also be statements made regarding methods by which the measurement instruments were tested for reliability. You will outline this information in your second and third sentences.

- **Outcomes measured.** The primary (main) and secondary (lesser) endpoints of the study should be clearly delineated. One example of a measured outcome is event rates; another example is determination of the magnitude of an association between a risk factor and an event, which is measured as relative risk, odds, or hazards. You will describe the primary outcome measure in the third or fourth sentence.

- **Data analysis.** This section may include information about the estimated sample size, and should always outline tests used in the statistical analysis. Generally, you may omit this information in your paragraph unless it provides evidence for a strength or weakness you will outline at the end of the paragraph. The only exception to this generality is that you should list the variables included in any multivariate model used by the investigators.

**Results.** There are two types of results.

- First you will mention the patient results. you will want to describe how many people in each group were included in the final analysis and you will also want to note if there is any dissimilarity in the baseline characteristics, if two or more groups are being compared.

- The second type of result presented will be the outcome results. These will include raw numbers (means, proportions, percent change, risk/odds/hazard ratios: the difference between these will be the effect size), as well as the statistical results (p-values, confidence intervals). You must report the most important of these in 2-3 sentences that outline the results.

**Discussion.**

- The study conclusion will most often appear at the beginning of the discussion section,. You must conclude your report of the study with a sentence that summarizes the conclusion of the investigators.

- For the rest of the discussion, the investigators should discuss strengths and limitations of their study and place the results in context with the results of other, previous studies. You will not need to report the points that you see in the discussion, unless you would like to.
How to summarize a study in one paragraph
The first sentence should include such information as the year the study was published, the type of study, the number of subjects, the year of publication, the geographical setting, and the study objective. Try not to include the first author’s name followed by et al: this is being discouraged in professional medical writing. This first sentence should be followed by the citation number in superscript (after the period at the end of the sentence).

After the first sentence should come 3-4 sentences summarizing the study methods. Note which drugs were compared and for how long. Also emphasize any notable methodologic aspects of the study that were particularly well done or that may have biased the results. Consider subject selection and measurement methods.

The results should then be summarized in 2-4 sentences that report raw numbers as well as the numbers showing statistical significance (or lack of). Try to limit your result information to the most important (as you see it) 2-3 pieces of information found in the results. It is important to be sure that your summary contains the most interesting point that you gained from reviewing the journal article. This point may not be an important part of the results, but it should be something about the study that you felt was very educational, either in a positive or negative way. Your last sentence in this section should summarize the authors’ conclusion.

It is effective to conclude the paragraph with a statement summarizing whether the study does or does not support use of the treatment for the condition.

If you want to try evaluating the study, you are welcome to note one strength and one limitation of the study. Please realize, however, that you are not expected to do so in this drug information paper. We will cover evaluation of the medical literature in your third professional year.

This should give you a paragraph for each study that contains approximately 7-15 sentences.
A blinded, placebo-controlled, randomized controlled trial published in 2000 examined the comparative effectiveness of ramipril and vitamin E in 9297 adults from 267 centers in North America, South America, and Europe. Patients aged 55 years or older who had a history of coronary artery disease (but no history of heart failure), stroke, peripheral vascular disease, or had diabetes and one other risk factor, were randomized to ramipril plus vitamin E, ramipril plus placebo, vitamin E plus placebo, or placebo plus placebo. All subjects took either ramipril 10mg or a matching placebo daily, and vitamin E 400 international units or matching placebo daily. The primary outcome measure was occurrence of, or death from, myocardial infarction (MI) or stroke, and this particular publication focused only on the ramipril versus placebo arm of this study. Fourteen percent of the ramipril group and 17.8 percent of the placebo group experienced a primary outcome event, with a relative risk (RR) of 0.78 and 95% confidence interval (CI) 0.7 to 0.86 (p < 0.001). This risk reduction was significant for the individual events of myocardial infarction (RR 0.8; 95% CI 0.70, 0.90), stroke (RR 0.68; 95% CI 0.56, 0.84), and death from cardiovascular cause (RR 0.74; 95% CI 0.64, 0.87), but not for death due to non-cardiovascular cause (RR 1.03; 95% CI 0.85, 1.26). There was a slightly higher percentage of patients with a prior MI and receiving calcium channel blockers in the placebo group. Fewer people in the ramipril group developed heart failure (9.0%) versus the placebo group (11.5%): RR 0.77; 95% CI 0.67, 0.87). The investigators also noted a statistically significant reduction in the new diagnosis of diabetes in subjects receiving ramipril (3.6%) versus placebo (5.4%). The investigators concluded that the use of ramipril significantly lowers cardiovascular event rate and mortality. This seminal study was the first to examine clinically-important endpoints associated with use of an angiotensin-converting enzyme inhibitor (ACEI) and these data will change clinical practice guidelines, worldwide. The risk reduction for development of diabetes is intriguing and warrants further investigation. The slightly higher percentage of patients in the placebo group with a prior MI and receiving CCBs should have been accounted for with multivariate analysis. Both could be markers of patients at higher risk of experiencing a cardiovascular event and so could confound data interpretation. This trial suggests that ramipril may lower the risk of cardiovascular events, including death.


Note: the italicized sentences are evaluatory comments about the study. For this paper, you may omit such comments without any adverse effect on your grade.
### Description of studies you will see in the medical literature

<table>
<thead>
<tr>
<th>Type of study</th>
<th>Briefly, how it works</th>
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<tbody>
<tr>
<td>randomized, controlled trial (RCT)</td>
<td>Each group assigned to a treatment (for control group, treatment may be a placebo). Members of each group are followed over time to determine whether events more commonly occur in one group versus another. When the same people are in each group (i.e., all the people in the treatment group are also in the control group) the trial is called a crossover study.</td>
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<tr>
<td>pilot study or non-controlled trial</td>
<td>One group of patients is assigned to a new treatment, and there is no control group. The outcomes of the patients are summarized and reported.</td>
</tr>
<tr>
<td>cohort study</td>
<td>A group of patients is followed over time. Risk factors for patients experiencing an event are compared to those patients not experiencing an event.</td>
</tr>
<tr>
<td>case-control study</td>
<td>A group of patients experiencing an event (“case”) is first identified. Another group of patients who did not experience the event (“control”) is then identified by a set of matching criteria (e.g., age, sex). Differences in risk factors between cases and controls are then compared.</td>
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<tr>
<td>cross-sectional study</td>
<td>Data gathered from a group of people presenting for a pre-identified purpose at one point in time (e.g., a single office visit or at the first visit for a new study) are explored to determine if prior exposure to a risk factor was associated with the purpose for which that person presented at that one point in time</td>
</tr>
<tr>
<td>meta-analysis</td>
<td>Data from a group of already-completed studies are grouped together and evaluated statistically. A meta-analysis is not the same thing as a review, because the data are analyzed statistically.</td>
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<tr>
<td>pharmacoeconomic study</td>
<td>Data about costs associated with the use of a particular medication or group of medications or procedure are evaluated.</td>
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<tr>
<td>case study</td>
<td>Data from a single patient is explained and analyzed. If more than one patient is highlighted, this type of study can be called a case series.</td>
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<tr>
<td>non-human studies</td>
<td>This includes data from animal studies and studies using in vitro models. While these are useful for elucidating mechanism of action or toxicity information, they are not useful for determining drug effectiveness or toxicity in humans.</td>
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</table>

Note that this list does not contain reviews. This is because reviews are a type of tertiary literature, while all study descriptions just noted are types of primary literature.