BIOS 6621 Statistical Consulting Document – 2009/2010 – Grunwald

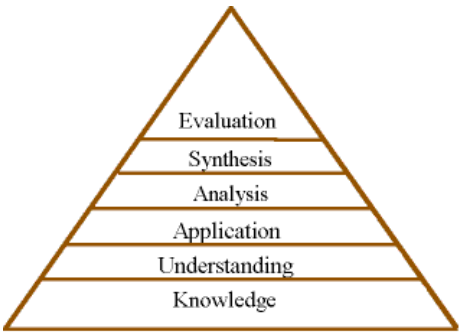
Introduction

The purpose of this document is to present some of the basic techniques of statistical consulting, and to provide advice and experience in some statistical aspects of consulting.

Some particular non-statistical characteristic of statistical consulting are working with diverse clients, project management, working with data that may be strangely formatted or contain errors or problems, and judgments about analyses based on non-statistical considerations. Some particular statistical topics that arise in statistical consulting are being completely comfortable with some basic principles and methods of statistics, selecting appropriate statistical analyses, being aware of and watching for common statistical pitfalls, and being comfortable with some basic statistical and computing methods. One of the main themes of this document is avoiding blunders, which can arise at any stage in a consulting project.

The goal is to develop expertise in statistical and non-statistical aspects of consulting. Expertise involves several high-level components, and is often said to require 'situational awareness', a complete view of the situation at all levels. An analogy might be when learning to drive a car you are focused only on the road immediately ahead, but after years of experience you also know where cars are around you, road and weather conditions, behavior of other drivers, where hazards might arise, warning lights in your car, etc. In statistical consulting situational awareness encompasses not just the details of the statistical analysis but also trade-offs among potential other analyses, the nature and experience of the investigator, proposed use of the analyses, other literature, time and money constraints, etc. Developing this awareness is a goal of this document.

One aspect of learning statistics in a consulting setting that differs from the typical classroom setting is that consulting typically involves 'higher levels of learning'. Levels of cognitive learning were described in the education literature by Bloom (1956). (Some google searching on terms like 'Bloom's taxonomy' lead to some very interesting and useful reading.) Briefly, Bloom describes several levels of learning:



The lower levels involve recall or recognition. The middle levels involve carrying out specific tasks or work. The higher levels involve selection, comparison,

assessment, etc. In class we usually know the general area, topic, chapter, etc, which tends to place work at the lower levels. This is entirely appropriate for first encounters with material. However, in consulting we often know little about what sort of work is needed. A consulting session may involve any analyses the statistician has ever encountered, as well as some that are not familiar, or even situations where no good solution exists. This places us in the higher levels of learning. An ability to scan all of these possibilities and determine appropriateness for the given situation is another aspect of expertise. One of the aims of this document is to develop some structured methods for breaking higher level situations into somewhat lower level situations, and to provide experience in dealing with situations at all levels.

This document gives my opinions as a result of my experiences, and there is plenty of room for other and sometimes quite different opinions, many of which I would not argue with. In particular, people working in different settings (e.g. a hospital or company) or dealing with different types of studies (e.g. surveys, designed experiments) would probably have very different thoughts on some things. The sections are not considered complete or definitive but hopefully give a good place to start discussions.

Some essentials of consulting

1. Interest in learning about areas of health sciences
2. Communication, especially
   a) explaining methods and/or concepts to investigators, and
   b) obtaining information from investigators
3. Good time and work management
4. Ability to help investigators formulate and refine questions
5. Facility with software
6. Good data cleaning, management and display skills
7. Broad knowledge and understanding of statistical concepts and methods