EXPLORING THE DEVELOPMENT OF AN N = 1 CASE STUDY MODEL FOR HERBALISTS

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ABSTRACT

Aims and objectives: The aim of this paper is to provide an accessible single case study protocol that professional herbalists can use in practice to produce scientifically sound research that may contribute to the growing field of herbal research.

Background: CAM, including herbal medicine, is widely used in the U.S., yet there is little scientific evidence supporting its efficacy. Herbalists are currently uninvolved in scientific research concerning their own medicine. It is likely that herbalists would like to contribute to the development of the knowledge base in their field of herbal research, yet many practicing herbalists are limited by time, research knowledge, and resources to conduct large scale studies. This study was undertaken to determine if a clear, understandable and accessible method for herbalists to conduct meaningful research could be developed using the single subject design (N=1).

Design and methods: Published literature from the biomedical, social science, and complementary medicine fields, are systematically explored and critically reviewed considering issues of usefulness, validity, model options and design. Benefits and limitations of various N = 1 models' relevance to herbalism is explored and critically evaluated to create an herbal case study model skeleton, including a visual display.

Results: Using the N = 1 pre- and post- test model, previously used by CAM researchers, detailed guidelines and examples, in the format of a protocol, are provided for herbalists to implement in practice.

Conclusions: The N = 1 pre- and post- test case study design provides a scientifically sound, yet accessible and appropriate method for herbalists to conduct meaningful research which can contribute to the growth and maturation of their profession. Scientifically sound herbal research by herbalists may also educate the biomedical community, providing foundational data suggesting medicinal use of herbs for future funded studies, as well as serving to inform conventional medical practitioners of the efficacy of individualized herbal treatment, thereby improving the status of professional herbalists.

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1. INTRODUCTION

1.1 Introduction to the Study

The most recent population study of complementary and alternative medicine (CAM) use among adults in the U.S. reveals that 62% of adults used some form of CAM in 1997 (Barnes et al 2004). Over 24% of this population used over the counter (OTC) self-prescribed natural products (Barnes et al 2004). An additional 12.2 billion to 19.6 billion dollars was spent, out of pocket, for the services of professional CAM health care providers (Barnes et al 2004). The public is seeking and using CAM; the scientific community is responding by studying this type of medicine, including herbs, to establish an evidence base for its use (OCCAM 2005). Evidence Based Medicine (EBM) most frequently employs the randomized controlled trial (RCT), the 'gold standard', to demonstrate herbal medicine's efficacy (Thachil et al 2007). These studies, while important for determining the efficacy and safety of OTC herbs, may not adequately reflect herbal medicine's full potential, particularly how herbalism is utilized by professional herbalists (Thachil et al 2007; OCCAM 2005). Practicing herbalists in the U.S. often face a frustrating bias from the medical community, reflecting caution and hesitancy in accepting herbal medicine as a valid healing modality. A paradox is that conventional Western Medicine is incorporating CAM into practice and patient care while simultaneously rejecting those whose practice and expertise lies solely in CAM, including herbalists. Notably, the usage in hospitals of CAM therapies and remedies is increasing at the same time that CAM providers continue to be widely excluded (www.woodwinds.org). Currently there is little published research about herbs that

involves the expertise of herbalists. To address this gap in knowledge and contribute to the growth of the discipline of herbal medicine, practicing herbalists need to be sufficiently equipped and knowledgeable to contribute, critique, and respond to relevant research.

Most professional herbalists lack the time, research knowledge, and resources needed to conduct randomized, controlled trials (RCTs) of their treatments (Walach et al 2002). However, this author believes that most professional herbalists would choose to contribute to herbal research and the development of their discipline if they had a clear, accessible method to conduct meaningful research. There is a continuum of research methodologies. Though one end of the continuum, RCTs, is beyond the means of many practicing herbalists, other equally meaningful methods are not. One of these is the case study, which can serve as an understandable, useable research tool for the everyday herbal practitioner. A case study focuses on one example of the thing that is to be studied, where boundaries are unclear, thus truly reflecting life (French et al 2001). To date case studies in herbal medicine have been anecdotal presentations of unique scenarios that provide learning opportunities but that often lack a standardized format, limiting the case study's utility and contribution to our growing discipline (Cabrera 2005; Bergner 1997).

In response, this study was undertaken to develop a scientifically sound protocol for the case study and, by extension, the case series. An underlying assumption is that case study research strategies are critical, necessary components of a growing research base for

herbal medicine. The properly conducted case study will serve to educate both the herbal and biomedical community, contributing to the growth and development of the discipline of herbal medicine. By sharing the insights of a case, or group of cases, with other practitioners and submitting these to peer review and scrutiny, empirical herbal knowledge will grow our discipline and profession (Zick 2004). In addition to contributions within our discipline, there are potential contributions to the conventional medical discipline. For example, case study findings can provide foundational data suggesting medicinal use of herbs (Zick 2004). Furthermore, sound case study research, which reflects herbalism as it is actually practiced, could also serve to inform conventional medical practitioners of the efficacy of individualized herbal treatment, thereby improving the herbalist's professional status (Ottenbacher 1986).

This author hypothesizes that a case study research protocol can be developed for herbalists using the N=1 design model.

By systematically exploring and critically reviewing published literature from the biomedical, social science, and complementary medicine fields, this author will address issues of usefulness, validity, model design, and model options. Limitations and assumptions of previous researchers and this author will be identified. Benefits and limitations of various N=1 (single-subject design) models will be explored and evaluated in the context of other research methods for their applicability to herbal medicine. Future issues for herbalist researchers employing an N=1 model in conducting research will be outlined.

1.2 Aims and Objective

The aim of this study is to explore and develop an accessible case study protocol for practicing herbalists, using the N=1 model as a starting point.

Case studies are the oldest form of research (Jenicek 2001). The case study has been downgraded in the scientific evidence hierarchy following the entry of evidence-based medicine (EBM) in the early 1960s and emphasis on quantitative over qualitative research (Glasziou et al 2004). In partial recognition of the limitations, French et al (2001) note that because there are so many uncontrolled variables in a case study, it is suitable to explore and describe but not to explain the phenomenon being studied. The internal and external validity of the case study is considered weak (Denscombe 2003).

Even given its weaknesses, the case study must be acknowledged as a powerful research tool (Jenicek 2001). Yin (2003) argues that case studies are better able to explain the effects of real-life interventions that are too complex for experimental designs to capture. Indeed, the case study is meant to address the 'how' and 'why' of a phenomenon (Walshe 2004). It is a memorable teaching device (Mcnaughton 1995). Another benefit is that it provides an outlet for clinical practitioners to share their experience with other practitioners (Aronson 2003; Mcnaughton 1995). Another frequently cited argument for the case study is that it provides results that stimulate further research (Aronson 2003; Fugh-Berman 1996; Huth 1999; Jenicek 2001; Vandenbroucke 2001; Zick 2004).

Social sciences have made use of the case study, and it is that field which has provided much of the work on validity, including defense of the case study as a valid model (Yin 2003; Glasziou et al 2004). The social science case study favors nuanced narratives over statistical analysis (Yin 2003). These two threads—the biomedical case study and the social science case study—can be woven through the N=1 to create a mixed method design (Verhoef et al 2005). The mixed method N=1 case study combines the element of an experiment, in that it examines the effect of a specific intervention with quantitative data, such as quality-of-life measurements, with descriptive data from the practitioner and patient (French et al 2001). Together these may explain the 'how' and 'why' of the treatment effect from multiple viewpoints.

A case series is a special type of case study in which multiple case studies are combined and evaluated to inform and explain more than can be seen when examined independently (French et al 2001). The sampling of biomedical case series shows a consecutive series of cases often centered on a disease diagnosis and utilizing statistical analysis. Both the complementary and biomedical field have formed case series by combining a series of N=1 cases for analysis (Jackson et al 2006; Wegman et al 2005).

1.3 Conclusion

CAM, including herbs, is actively being used by the public. The scientific community is conducting research to develop an evidence base, primarily using the gold standard RCT.

The case study is an important and useful research tool which may allow everyday herbalists to participate and contribute to research which will serve to educate both the biomedical and herbal community. This author proposes to critically review and synthesize information from the behavioral sciences, biomedical and complementary medicine communities who have adopted the N=1 single-subject design in order to develop a protocol which may be used by practicing herbalists.

2. METHODOLOGY

2.1 Literature Search Method

2.1.1 Resources for First Literature Search

The author made use of the following electronic search engines:

- PubMed provided access to Medline December 9, 2006 through October 18, 2007.
- Ovid, through the University of Minnesota, Minneapolis, provided access to the Health Index database, CINAHL and AMED December 9, 2006 through October 18, 2007.
- Goggle's database was utilized December 19, 2006.

The author made use of the following text-based resources:

- Northwestern Health Sciences University's library provided access to journals of Chinese Medicine, Chiropractic and Complementary medicine.
- Diehl Hall Biomedical Library and Wilson Library at the University of Minnesota, Minneapolis, provided books on systematic literature searches, research methods and books concerning the case study and single-subject design October 6, 2006 through October 18, 2007.
- All other books were accessed through the Minneapolis Public Library's World Cat interlibrary loan system December 2006 through September 2007.

- The author hand-searched her archives of the herbal peer-reviewed journals *Medical Herbalism* and *Journal of the American Herbalist Guild*, 1997-2006, for the case study and case series.

2.1.2 Search Strategy from October 2006 Through January 2007

The author initially developed an extensive list of key words to search. Her initial search used the key word 'case series' on Medline and the University of Minnesota's book catalogue. This provided little information. The combination "'case series' OR 'case report' AND 'writing'" was extremely productive.

Writing, according to Medline's MeSH (Medical Subject Headings) tree structure, covers publishing, publication bias, and the writing or written versions of cases. The author then used a cited reference search strategy, pursuing selected references from full text articles. Key authors were searched using an author search (i.e., Elwyn, Greenhalgh, Jenicek, Mays, Pope, Mcnaughton, Sackett, Scheid, Vandenbroucke, Vickers). Relevant books cited were also pursued. A later article reference to 'consecutive case series' led to the biomedical case series in September 2007.

Initially, 'complementary medicine' and 'alternative medicine' were also used as keywords, but those words overly limited the search in PubMed, and those topics were included in the articles pulled up by the other keywords. In AMED, 'complementary' and 'alternative medicine' were redundant, as AMED (Allied and Complementary Medicine) already focuses on those topics. "Research" was also used as a keyword in CINAHL and AMED. "'Clinical trials' AND 'complementary medicine" were searched

on PubMed for RCTs. "'Preference trials' AND 'preference trials'" were also searched. "'Medicine, herbal' AND "'clinical trials'" proved redundant since all citations were included in the Mesh headings of 'clinical trials' AND 'complementary medicine.'

Inclusion criteria. Open dates were utilized in the search. All languages were included, although the author could only read articles translated into English. All articles were included because this author did not want to exclude foreign language articles that might have been translated into English. Qualitative research was included, all concerning case studies, whether single or multiple, and occasionally including quantitative measurements. Articles focusing on case study justification, development, language, or guidelines were included. Case studies that involved complementary medicine were included, as well as biomedical cases that involved narrative. RCTs and preference trials that focused on herbs were included.

Exclusion criteria. After reading multiple case study guidelines for other medical fields through Medline, the author excluded case study guidelines in such fields as oncology, neurology, social work, lactation, anesthesia, and wound management in both CINAHL and AMED. This author chose to exclude these case studies because the medical language used for the specific fields in the described case studies was deemed unuseful as a model for the broader population of herbalists. Those cases were excluded following individual abstract review. Although biomedical case models were included, biomedical cases themselves were eventually excluded, as they contained almost exclusively

extensive detailed medical testing data rather than the data herbalists would likely use in case recording.

2.1.3 Search Strategy from September 3, 2007 through October 18, 2007

The information concerning the case study and case series found in the qualitative research literature was judged to be too poorly defined and inappropriate as a basic model that herbal researchers might easily utilize in practice. The biomedical community's models also did not reflect the concerns of herbal practitioners.

A new search was conducted through the above named search engines and libraries to focus on the single-subject design as a possible method for herbalists to pursue herbal research in practice. Literature, including electronic journal publications via Pub Med and related books, were found through cited reference searching from key articles provided by the Scottish School of Herbal Medicine. Key authors were selected and searched through an author search (Guyatt, McPherson, Verhoef). Additional information was sought through AMED and CINHAL using "' single-subject' OR 'single subject' AND 'research design,'" and this provided the key article by Jackson et al (2006), as well as other CAM N=1 pre- and post-test studies.

Inclusion criteria. The single-subject design was developed in the behavioral sciences and converted into a viable method within the medical community for individual medical practitioners. All dates and languages electronically published in the behavioral sciences,

medical profession and the Evidence Based Medicine community that referenced the single-subject design were included.

Exclusion criteria. Articles not appearing to address the validity or design of the single-subject model were excluded. This decision was made by thematic analysis of the title, abstract, and keywords listed.

The author made use of the following subject matter expert (SME):

- The author consulted Carolyn Garcia, PhD, a University of Minnesota assistant professor who utilizes the quasi-experimental pre- and post-treatment study for complementary medicine research January—March 2008.

2.2 Methodology of the Research Question

2.2.1 How This Research Was Conceived

The development of the case series as a research tool for practicing herbalists initially arose from Matthew Wood's MSc dissertation (2006), which cited Fugh-Berman's (1996) comment that a five-case series was considered valid research for evidence. However, extensive research by this author concluded that five was randomly assigned by Fugh-Berman and not used by any other sources concerning case series. Further research revealed that Fugh-Berman considered 'evidence' to mean merely evidence for further study.

The herbal community in the U.S. (American Herbalist Guild) is concerned with the insufficient amount of research published by the herbal community. Research is important for developing the knowledge within a discipline and the external status of a profession (Ottenbacher 1986). The author hoped to contribute to the field by developing a simple model for herbal practitioners to carry out research within their practices.

An Internet literature search from October 2006 to January 2007 on search engines Pub med, CINHAL and AMED uncovered many useful articles and books in defense of the usefulness and validity of the single case study, although often not as evidence per se (Jenicek, 2001). Little reference was made to the case series.

2.2.2. How the Research Question was Refined

Initially this researcher intended to pursue an exclusively narrative method of case series design, as clinical practitioners write their case notes in prose. The initial pursuit of case series design through social science qualitative research and biomedical and herbal literature showed not only that there was no distinct model available for the single case study, but that the case series itself was considered a complicated variant of the case study. French et al (2001) notes that the case series is sufficiently complicated to present a major challenge for a beginning researcher.

Awareness of this complexity led to the notion that practicing herbalists beginning research for the development of the profession would be best served by starting simply with a methodologically sound single case study design that might be combined later, by

future researchers, for a case series. The single-subject design (N=1) has been used in the behavioral sciences and medical profession to document cases by individual practitioners and it was hypothesized that this might be a useful tool for practicing herbalists. The focus of the study was thus narrowed. The paper would develop a feasible method for using a case study in practice, based on the N=1 model, with a basic acknowledgement of how those individual cases might later be combined into a series.

2.3 Design and Execution of the Research Project

The proposed design and execution of the research project is to:

1. Critique published research within the behavioral sciences, the biomedical field, and CAM, to identify research design considerations.
2. Evaluate published sources to identify relevant complementary medicine research concerns.
3. Use experiences as a practicing herbalist to interpret literature search findings and their feasibility for herbalists' use.
4. Utilize biomedical and complementary medicine data to create the skeleton of a model.
5. Present a visual display of the model.

2.4 Limitations of This Study

This study advises that beginning herbalist-researchers start small. Vickers, an integrative medicine research methodologist, advises that researchers recognize that they need to take small steps and start with simple questions to develop research (2002). Research is

rarely definitive but rather adds to a pool of study (Vickers 2002). Considering Vicker's commentary and the state of research experience and knowledge within the herbal community, the depth of knowledge necessary to carry out a qualitative case study protocol would limit the number of herbal practitioners utilizing the approach. Thus the quantitative/case record version is explored in this paper.

The term *case series* denotes a strategy, not a method (Denscombe 2003) and is a type of case study (French et al 2001). The case series, although acknowledged and explored, will not be fully developed in this paper. Evidence supported the development of the single case study, at this time, for herbalists.

3. REVIEW OF THE LITERATURE AND CRITICAL EVALUATION

3.1. Introduction

'A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident' (Yin 2003 p. 13). The case study strategy is chosen because the researcher believes that situational factors have a direct effect on the phenomenon under study (Denscombe 2003). Therefore, it is considered a holistic approach. The case study focuses on just one example of the thing that is being studied (French et al 2001).

The case series is a type of case study (French et al 2001). Both terms denote a strategy rather than a particular research method (Denscombe 2003). Biomedical examples of the 'consecutive case series' combine many cases, often around a disease diagnosis, utilize medical testing to gather data, and compile that data.

On the other hand, the narrative/qualitative version (e.g. interview, observation, field notes) of the case series is extremely flexible. It often utilizes triangulation, which entails gathering information through multiple techniques such as in-depth interviews, participant observation and/or focus groups and comparing the data to establish congruence (Bowling et al 2005). Triangulation is also used to provide challenging and contrasting views as a validity strategy, although it is not expected to provide definitive answers. Morgan (1998) argues that health researchers may not be able to afford the

effort to simply find the same thing out three different ways, or even twice. Mixed methods, which combine qualitative data such as open-ended questions to elicit a patient's experience, and quantitative data, such as quality-of-life measurements, provide complementing data which comprehensively shed light on health care experiences. Triangulation is a useful validity strategy, notably for qualitative research; a mixed method research design incorporating quantitative and qualitative data sources may be more accessible to a practicing herbalist undertaking case study research (Adamson 2005).

3.2 The Case Study's Status in History

Case histories are the cornerstone from which medical research is built (Vandenbroucke 2001). Observation, practice and subsequent conclusion has been the basis of all learning (Jenicek 2001). This learning was communicated in many professions as the case history. Through trial and error, humans learned from their mistakes and triumphs and developed a system of medicine.

3.3. Introduction of the Evidence Hierarchy

In the 1940s, the randomized controlled trial (RCT) was formally introduced into the arsenal of research methodology (Walach et al 2002). In the 1960s, Campbell and Stanley advocated RCTs as the most objective way to demonstrate a cause and effect relationship (Campbell et al 1963). The Evidence-Based Medicine (EBM) Working Group developed a hierarchy of valid research evidence for practitioners to reference (Guyatt et al 2000). At the top of this hierarchy is the 'gold standard'—the RCT. At the bottom is the case

history (Vandenbroucke 2001). In between lay case series, observational studies, including cohort studies, as well as larger pragmatic and preference trials.

By the mid-1990s, EBM was publicly disseminated and embraced by leading medical journals such as the *British Medical Journal* (*Lancet* 1995). Indeed, other disciplines including nursing and public health now have distinct definitions of what evidence-based is and what types of research contribute to their respective evidence-bases.

Observational, qualitative case histories were ranked lowest on the hierarchy of research evidence due to low external and internal validity. Case histories often had poor internal validity because clinical practice and case write-up methods vary from practitioner to practitioner, limiting the ability to verify findings by reproducing results. Furthermore, being only one, or a cluster of cases, the case history had low external validity, as it was not generalizable, as conclusions could only apply to the subject(s) studied in the case.

3.4 Importance of the Case Study

3.4.1 Importance of the Case Study in Medicine

Case studies serve many purposes in medicine. They are memorable teaching tools, still used in medical schools and medical conferences (Mcnaughton 1995). Case studies teach insight over rote memorization (Vandenbroucke 2001). The results of case studies tend to be more comprehensive, intelligible and interesting to many people, and therefore appeal to a wider readership (French et al 2001) than studies based solely on quantitative data. For example, mainstream news publications such as the *New York Times* Sunday

Magazine and the *Science Times* section of the *New York Times* on Tuesdays routinely publish clinical case studies, suggesting public interest and demonstrating the case study's value to the layman for education and entertainment (see 'Diagnosis' and 'Cases', respectively).

Practitioners value case reports. Case reports for clinical practice are usually descriptive but concise; in contrast, case studies often entail an extremely detailed, systematic description and analysis of a single case (French 2001). Jenicek (2001) notes that case reports are a regular feature of leading medical journals, such as *The Lancet.* French (2001) points out that professional journals represent politically sensitive organizations that may reject articles opposing established views and instead concentrate on particular, accepted forms of research. Case reports persist despite the EBM hierarchy of evidence that places case studies at the bottom. Case reports comprised 13% of articles in all leading medical journals, and 38% of the reports considered ten or fewer patients (Jenicek 2001). The *New England Journal of Medicine* section 'Clinical Problem Solving' uses individual cases to teach clinical medicine (Jenicek 2001). Clinical case publication allows dissemination of empirical findings and methods into clinical practice through means beyond casual conversations with colleagues (Aronson 2003).

3.4.2 The Case Study's Importance to Research

During a period of heated debate concerning the undervaluation of qualitative research, Sackett, the most well known advocate of EBM, claimed in the *British Medical Journal* that all studies should be considered useful, including qualitative studies (Sackett et al

1996; Sackett et al 1997). Merely because research 'low' on the evidence hierarchy, such as the case study, was not recommended by EBM as sufficient evidence to dictate practice, it was an incorrect interpretation that those studies therefore served no purpose for the medical community. Jenicek, another EBM advocate notes that case reports, as foundational evidence to draw research attention, can serve as 'the first link in the chain of evidence' and inspire larger, more sophisticated research inquiries (2001, p. 95).

The Medical Research Council (MRC) of the United Kingdom proposes qualitative research and observational trials to study components of an 'emergent Whole System Research framework' (2005 cited in Boon et al 2007, p. 4) for studying medicine as it operates in a real-world setting. As a current trend, whole systems research advocates that all types of research, from case studies to RCTs, are necessary and useful to promote understanding of different types and aspects of medicine in all of their complexity (Verhoef 2007). Case studies enable a holistic approach that reveals and unravels complexity within a certain circumstance (French et al 2001). Intrinsically, case studies focus on real-life events and are therefore valid and appropriate for researching herbal medicine.

3.4.3 Importance of the Case Study for Herbalists

As noted earlier, in that they present possible answers to questions of health, clinical cases constitute research. The discipline of herbal medicine risks being subsumed by the biomedical model if professional herbalists do not undertake research to validate holistic approaches in clinical practice. Indeed, research and published, peer-reviewed findings

are important to a profession's development and status, as well as to growth of the discipline's knowledge base (Ottenbacher 1986).

U.S. consumers are currently spending money on CAM. This has stimulated scientific research, using the biomedical model, to establish the value (or lack thereof) of this type of medicine. For example, the U.S. National Cancer Institute's office of Cancer Complementary and Alternative Medicine currently offers guidelines for their 'Best Case Series Program'. The program uses 'the same rigorous scientific methods employed in conventional medicine, for patients treated with alternative medicine' (OCCAM, *NCI best case series criteria for optimal case studies*, 2005). The guidelines require rigorous medical testing throughout the CAM treatment. It is a rare herbalist who would have the access to and acceptance by a conventional medical facility necessary to conduct extensive medical testing during an exclusively herbal course of treatment of a life-threatening illness such as cancer. These guidelines would in effect exclude herbalists from participating in this funded research, even as we recognize the importance of research in sustaining and developing our unique discipline and professional scope of practice.

An accessible research model for practicing herbalists must be developed so contributions can be made from within the holistic context in which the research occurs. Research by practicing herbalists may serve to inform the biomedical community of further areas of potential study and lead to the inclusion of herbalists in larger, funded studies.

3.4.4 Case Study and the Scientific Method

The scientific method lays out a series of steps in which an individual's findings can be verified by a community that repeats a particular study and reaches consensus about the results and their meaning (Wahl 2005). Clinical cases are part of an herbalist's daily practice. Because of their knowledge, and for professional development and status, herbalists should be leading forces in herbal research. A systematic research and evaluation strategy utilizing clinical experience can be developed.

3.5 Model Options

3.5.1 Model Flexibility of the Qualitative Case Study and Series

A case study is defined by its focus on one instance of the thing that is to be investigated (French et al 2001). Case reports are usually descriptive but concise, often focusing on clinical practice, while case studies often entail an extremely detailed, systematic description and analysis of a single event, institution, group or person within a real-life context (French 2001).

The qualitative model is considered flexible. It ranges from reflective musings about practitioner-patient relationships (Elwyn 1997) to longitudinal, social science studies of whole systems (Stake 1995). Just as the model is flexible, so are the write-ups, which may range from a few to hundreds of pages. The narrative/qualitative version of the case study and/or series is highly flexible. Despite the flexibility of design, the scientific community will consider the research poor if the method is not clearly outlined (Yin

2003). For example, Cabrera (2004) notes that the research utility of interesting clinical cases, often identified retrospectively, are sometimes reduced by practitioner case notes that are poorly documented by scientific standards. The narrative/qualitative case study compiles extremely rich and detailed data (Yin 2003; Stake 1995); however, the purpose of this study is to develop a relatively simple, accessible research method for the everyday herbal practitioner. In depth qualitative research methods may be beyond the scope of time and research knowledge available to the everyday practitioner; this study focuses solely on quantitative case study, allowing for future exploration of qualitative case study research possibilities.

3.5.2 The Biomedical 'Consecutive Case Series'

'Consecutive case series' reported on by the biomedical community are typically single cases combined to form a series. A sampling of biomedical case series research finds them classified by disease (Leung et al 2000) or intervention (Duff et al 2002) and ranging from 63 to 10,000 cases (Min et al 2005). Case series are sometimes classified by setting and time frame, such as Everett's one-year study of injury types at a skate park (2002). Restricting a consecutive case series model to a given time period (i.e. 1 year) and to injuries incurred at a particular setting (i.e. a local skate park) allowed the researcher to accumulate a reasonably-sized record of the frequency and type of injuries at a location designated 'safe' for skateboarders. Everett's study, which was spurred by the lack of literature on injury occurrences at skate parks, produced safety recommendations. No narrative reference to individual cases was used in Everett's case series, though statistical analysis—one of the hallmarks of the biomedical case series—

featured prominently. Utilizing individual cases may be a useful framework for herbal case series, to the extent it provides case series guidelines. For example an herbal practitioner might chose to focus a case series based upon whatever number of clients with a particular health condition s/he sees in his/her office over a set time period, such as a year.

3.6. Issues of Internal and External Validity in Research

3.6.1 Case Study Validity

Much of Western science today focuses on the reliability and reproducibility of research. This has generally meant identifying and isolating independent variables that may affect the dependent variable being studied. Controls such as blinding and randomization were introduced to increase the internal validity (repeatability) of a study (Bowling et al 2005). External validity is identified as the ability to generalize the results of the research to other populations (Bowling et al 2005). The internal validity of real-life clinical practice is considered weak since neither variables nor treatment are controlled, often varying from case to case and session to session, making repeatability difficult. However, external validity can be considered high because clinical practice reflects real patient populations rather than participants chosen for a study, with an extensive list of exclusion criteria (Lewith 2002).

3.6.2 Validity of the RCTs for CAM (Including Herbal) Research

Although RCTs are a valid and useful research design, the assumption that the RCT is the best method to evaluate the practice of CAM has been questioned (Walach et al 2002).

Randomization is a statistical technique that often relies on single- or double-blinding. Blinding of all participants is deemed necessary because of 'placebo effect,' which occurs when the pharmacological effect of an intervention acts in conjunction with the psychological effects of expectation, hope and knowledge (Kleijnen et al 1994).

Tucker et al (2006) note that RCTs studying long-term outcomes are equally subject to psychological bias. This bias grows from the relationship that often develops naturally between people who meet regularly over a period of years.

Low external validity is a concern with RCTs (Lewith 2002). RCTs contain homogeneous populations because the trials are designed to control and exclude many real-life factors, including candidates with illnesses other than the one under study, a situation often seen in clinical practice. Eligibility requirements are so restrictive that often less than 10% of candidates are accepted (Larson 1990). Lewith (2002) notes that because RCTs frequently fail to reflect real patient populations in their complexity, their results often cannot be extended easily to real practice (Lewith, 2002).

RCTs were developed to evaluate an easily-measurable, single component of a treatment effect or a single aspect of a disease. The overall objective was to evaluate whether an intervention has a specific effect over and above the nonspecific effect of treatment and care. This type of research assumes an intervention would be specific and additive (non-synergistic) on a certain condition (Walach et al 2002).

CAM practitioners do not use these assumptions. They recognize that disease is complex, with multifaceted causality that may be influenced by a multitude of possible routes (Walach et al 2002). Herbalists, for example, assume a synergistic effect from multiple treatments often, although not always, involving more than one herb, believing that herbs assist the body in self-repair and consequently may affect multiple systems within the body, oftentimes affecting the mind and spirit as well (Mills et al 2000; Wood 1997). For example, a single herb such as *Verbena hastata* in practice affects the nervous, digestive and endocrine systems. It is effective, when used on the 'right' individual, in reducing hot flashes, dysmmenorhea, insomnia, irritable bowel syndrome, tics and spasms, including tight muscles, and in imparting a sense of relaxation and well-being (Wood 1997).

The high valuation of RCTs in biomedicine assumes that specific effects are the most valuable therapeutic action from an intervention, and that the demonstration of this effect, over nonspecific or synergistic effects, defines a more valid therapeutic intervention (Walach et al 2002). Studies that attempt to isolate the active component in an intervention, such as RCTs, may fail to capture all the effects that contribute to patient satisfaction. For example, a recent systematic review, using EBM's hierarchy of evidence, found that 'valid' studies of CAM, mainly RCTs, showed no evidence of efficacy in depression (Thachil et al 2007). Yet depression has been cited as one of the ten most frequent indications for using CAM (Kessler et al 2001).

Pharmacological specificity is one of many possible routes to improvement of a disease or condition. An RCT can optimally extract information when the diagnosis is concretely

defined and measured and the intervention is relatively simple and short (Walach et al 2002). This situation allows tight cause-and-effect links to be measured under blinded conditions.

Accepting these constraints, RCTs do have a place in herbal medicine. Many herbs are sold and purchased over the counter by customers seeking relief of specific symptoms, and RCTs may be useful in testing the usefulness of this type of self-prescribing, in which merely symptom relief is sought. For example, a small, randomized placebo-controlled trial tested the efficacy of Carmint (Vejdani et al 2006), an OTC combination of three carminative herbs thought to affect the digestive system, on irritable bowel syndrome (IBS) in 32 participants. Outcome measures showed a significant improvement of symptoms over the placebo in most participants. By RCT standards, the study was very small and probably considered insignificant, yet the result might inspire further study. This RCT demonstrates the use of herbs, not as herbal practitioners might address IBS, considering the underlying root cause, but addressing merely the symptoms. Currently herbal RCTs do not allow for the broader conceptualization of addressing the root cause, and not merely addressing the symptoms.

When herbal practitioners see clients with multiple health conditions and complex diagnoses, treatment is often neither short nor simple. Using RCTs exclusively to study herbalism reflects the incorrect assumption that herbs always mimic the specific and relatively quick effect of pharmaceuticals and ignores the often complex profiles of clients seeking herbal treatment. Today, a great deal of attention and money is focused on

CAM research. RCTs may demonstrate the effect of a standardized herbal medicine on a specific symptom, but for the herbal practitioner's profession it is also important to demonstrate the efficacy of individualized herbal treatments and their effects on the commonly complex individual.

3.6.3 Other CAM Research Options

Researchers are trying to address weaknesses in large CAM studies. Large pragmatic trials address the RCT's poor external validity by using minimal inclusion and exclusion criteria and using validated dependent variables such as quality-of-life measures which are more likely to reflect the most likely benefits of CAM treatment (Lewith 2002). Preference trials have been developed in response to the concern that randomization is not appropriate in CAM because patient preference is correlated with treatment effectiveness (Verhoef 2007). Furthermore, RCTs could be performed to test the efficacy of self-prescription by having a third person in the dispensary randomly assign the tailored prescription or placebo (Mills 2000). That said, RCTs, as with all study designs, have limitations and given the early stage of research by herbalists and the current shortage of funding, at this time a scientifically recorded case study is an appropriate and accessible starting point for practitioners to conduct research.

3.7 Introducing the N=1 as a Possible Model for Herbalists

3.7.1 The N=1 as a Valid Model in EBM

According to EBM (Guyatt et al 2000), best practices must be geared toward the individual patient in practice. In 2000, a group of physicians, writing for the Evidence-Based Medicine Group, suggested N=1 RCT trials deliver the highest strength of

evidence for making individual patient treatment decisions (Guyatt et al 2000). Guyatt et al argues that using data based on large studies forces the practitioner to generalize the results about other people to their patient, weakens inferences about treatment impact, and introduces complicated issues of how trial results apply to individuals (Guyatt et al 2000). As well as leading to the best clinical decision for a particular patient, the N=1 model may also serve to demonstrate the effectiveness of herbal practitioners using herbal medicine for a particular client.

3.7.2 N=1 as Quasi-Experiment

The N=1 trials were initially developed in the behavioral science field (Ottenbacher 1986). Experiments are designed to establish cause-and-effect evidence (French et al 2001). Controls are preferred to clarify treatment effect versus the natural progression of the disease. Since, in the N=1, the patient acts as his or her own control, the N=1 is considered a quasi-experimental design.

In the N=1 or single patient trial, one individual is recruited to his or her own individual trial (N=1). Ideally, the trial measures the effect of treatment on symptoms that matter most to the individual (Guyatt et al 1988). In the traditional N=1 trial, the individual serves as his own control, receiving all interventions, with multiple crossover periods. Comparisons are typically made between a single new therapy and a current standard therapy or a placebo (Bowling et al 2005).

3.8 Standard Trial Designs

3.8.1 The 'AB' Model for N=1

The simplest trial is referred to as 'AB'. The patient comes to the practitioner in an initial or 'baseline' state (A) and is given a treatment. During the treatment phase the patient then takes on a new state (B). No standard time period is recommended. If B was more desirable, we assume that the intervention was successful. If not, one might think the intervention was ineffective, or perhaps even harmful. Yet confounding factors not taken into account may have affected the results (Larson 1990).

Confounding factors are numerous but may include coexistent illness that coincidentally exacerbates the patient's condition or age-related decline that may superimpose itself upon beneficial treatment, which combine to cancel out both age-related effects and beneficial effects of the treatment (Larson 1990), or there may be the patient's psychological desire to please the researcher-practitioner, resulting in the patient reporting more improvement than has actually occurred. Not considering or controlling confounding factors would be considered a poor experiment (Larson 1990). The AB design is a common protocol in daily practice. A pre- and post-test design may serve as a possible model for herbalism, allowing for complex chronic illness often seen in CAM practice, as well as allowing for some 'confounding' factors that are considered acceptable and appropriate within holistic practice (Jackson et al 2006). The pre- and post-test model will be described in section 4.1.4.

3.8.2 ABAB Withdrawal N=1 RCT

Guyatt (1998) and other physicians at McMaster University have actively investigated the single-patient trial, adopting the more complex version of the N=1—the ABAB design (Guyatt et al 1988; *Lancet* 1986).

Gliner et al (2000) aptly defines the ABAB model. ABAB is a crossover or 'withdrawal' design. Once again the baseline phase (A) is observed. Here the treatment phase is referred to as 'B'. Treatment is then withdrawn. In biomedical N=1s, the 'real' medicine is usually substituted with an identical placebo during the withdrawal phase (A again) (Larson 1990). Placebo effects are a concern and are will be addressed in section 3.9.3. Withdrawal of the medicine (A) is considered a 'washout' phase, during which treatment effects should lessen or disappear. Then treatment is crossed over repeatedly, until there is clear evidence of effectiveness or ineffectiveness (or harm). A minimum of two A or baseline/withdrawal phases and two B or treatment phases is preferred. Phase durations are not specified. The trial is considered more internally valid if it is performed several more times. Treatment may be withdrawn sooner if there is evidence/concern of harm during the treatment phase. This design is flexible. The number of sessions making up any particular phase may be altered.

Gliner et al (2000) point out that since the ABAB Withdrawal design is inherently flexible it may be altered to accommodate other treatments. As in normal practice, the treatment may be inadequate. The practitioner-researcher may add an additional treatment as 'C'. Thus the sequence may follow an ABCAC pattern. B treatment may be

continued along with C treatment or may be replaced by C treatment. Changing of sequences may continue, always returning to the A phase for measurement.

3.8.3 Problems for Herbalists Using the ABAB Model

There are many obvious problems in the withdrawal design for herbal practitioners. According to herbalist Simon Mills (2002), to increase internal validity, the baseline 'A' period should be a relatively long time (a minimum of 6 weeks), during which time the outcome measures are recorded to demonstrate the variability of the illness being treated and wait for its acuity to stabilize (Mills 2002). Conventional medicine does not state a recommended baseline period. A long baseline allows the treatment phase 'B' to be an accurate measure of change, versus normal fluctuation or progression of the illness. Ethically, practitioners, as healers, cannot watch their clients suffer when the practitioner believes there is a reasonable relief at hand, with their treatment. On the practical side, as business people, practitioners do not want to lose clients while the client continuously records their own status, untreated. Inconvenience to the patient may be unappealing (Vickers 2002).

The withdrawal model also assumes that a treatment may be readily reversible. In complementary medicine, particularly herbalism in this case, it is widely expected that treatment is a slow progression of improvements, which may take several treatments, before the beneficial effects may be observed (Mills et al 2000). Furthermore, within holistic medicine it is not uncommon for a client to initially have aggravation of their symptoms or other 'side effects' such as headaches or skin eruptions. These transient

clinical effects are considered a consequence of the body detoxifying itself that will resolve in time and lead to better health (Mills et al 2000). Thus, the expectation that an herbal remedy will have immediate positive effect, that immediate negative effects are to be viewed negatively, or that the remedy can be withdrawn and the effects will be immediately reversed, is an inappropriate model for complementary medicine, and herbalism in particular. Therefore, a variant on this model, ABABCABCDA, designed to illuminate the effect of layered treatments, would also be inadequate to address this problem. Furthermore, the effects of treatment are not quickly 'washed out,' merely because the treatment is withdrawn (Jackson et al 2006; Mills 2002). Many herbs support self-corrective functions within the body that may last a long period, if not indefinitely (Mills 2002).

3.9 Problems Using the RCT N=1 Model for the Practicing Herbalist

3.9.1 Controls

Most features of the RCT model do not work well with herbal medicine. Many practitioners often see complex cases, many times utilizing complex herb combinations (Mills 2002). 'Controlling' to isolate symptoms and therefore ignoring the rest of the patient, or 'controlling' the medicine, perhaps by using only one herb, would not be true to real-life herbal practice, for most herbalists. Furthermore, because herbs often work on multiple organ systems within the individual, most cases would be confounded by nonspecific effects (Mills 2002). 'Confounding' but important and likely factors to occur in an herbal medicine treatment include (a) the placebo effect, which has been shown to affect about 30% of patients, both in CAM and biomedicine (Mills et al 2000); (b) the

hope and expectation of beneficial effects from both the practitioner and patient; (c) the practitioner-patient relationship, for good or ill; and (d) the patient's desire and willingness to please, or sometimes its very opposite—the patient's resistance to improvement in order to prolong the treatment relationship (Larson 1990). These factors are elements of the relationships that develop in complementary medicine practice. Isolating a disease and a medicine ignores the relationships that enhance the effectiveness of treatment. This is an acknowledged fact of alternative practice (Lewith et al 2002). A method to measure overall treatment effect would best acknowledge the efficacy of the complex and interrelated components of holistic practice (Walach et al 2002).

3.9.2 Blinding

Blinding is a feature of the RCT that enhances internal validity (Bowling 2005). Blinding must be considered in advance. Complete blinding of all participants would be impractical, unlikely and possibly unethical, if used by an everyday practitioner with paying clients (Janosky 2005). However, a third blinded observer, perhaps another herbalist or co-researcher, may be used to record and receive data measuring effectiveness, from the patient (Mills 2002).

3.9.3 Placebos

Placebos would also be a complicated feature to implement. Ethically and as business people, practitioners do not want to withhold treatment. Conventional medicine has hired pharmaceutical companies to make chemically inactive but similar-tasting placebos

identical to the medicine in order to completely blind all involved (Guyatt et al 1988; Lashner et al 1990).

This issue, for herbalist practitioners, is complicated by the fact that the distinctive taste of herbs, such as 'bitters', often stimulates certain healing reactions in the body. Studies have demonstrated that the oral ingestion of liquid herbal bitters, such as *Gentiana lutea* and *Artemesia absinthium*, stimulates gastric secretion in the stomach, bile production by the liver, bile release in the gallbladder, and an increase in pancreatic enzymes (Mills et al 2000). Mills et al (2000) suggest this effect is caused by an increase in vagal stimulation, which is caused by a nerve reflex from the bitter taste bud stimulated by bitter taste in the mouth. Furthermore, Mills et al (2000) cite studies which confirm that much of the activity of bitters is stimulated by oral ingestion, as opposed to swallowed directly into the stomach, in the form of a capsule or tablet (2000). Although non-herbalists might easily suggest encapsulating the herbal remedy so that an identical encapsulated placebo might be used, the example of bitters suggests that such easy answers do not address the complicated nature of the question.

Mills et al speculates that the bitter taste might be masked, by sweet, for example, and still have the desired stimulation on the bitter taste buds (2000). However, this author questions the effects of other taste stimulation, such as sweet, and the physiological cascades that it might also provoke in the body. This said, although some herbs, such as bitters, have been studied extensively, confirming that certain herbs stimulate certain physiological effects by triggering chemical cascades by oral ingestion, not all herbs may

have this mechanism. A recent small RCT was conducted using placebos of identical taste, smell and color, which confirmed the efficacy of carminative herbs on irritable bowel syndrome (Vejdani et al 2006), over placebo. A further complication of placebo implementation relates particularly to the withdrawal model, used in the RCT N=1. Vejdani et al's RCT implemented the placebo consistently with the control patients, rather than withdrawing them back and forth. These details and contradictions suggests that this is a complicated topic that would have to be very carefully thought out and addressed if placebo treatment were to be used in herbal research. Consequently, using placebos is not an adequate model for the everyday practitioner to implement easily at this time.

3.9.4 Time and Financial Considerations

RCTs control all confounding factors possible, isolating a disease to be studied; isolating treatment; blinding researchers, patients and practitioners; and offering identical placebos for the study (Bowling 2005). Using the N=1 RCT, McMaster University (Guyatt et al 1988) and the University of Washington (Larson et al 1993) have developed a trial service and study to help physicians develop best practice for their individual patients. At the University of Washington, 16.75 staff hours and 450-500 dollars were the cost of conducting an RCT version of the single patient trial (Larson et al 1993). Aside from its incompatibility with the way individualized herbal medicine actually works, the price for a single (or multiple) N=1 RCT may be too expensive for the single herbal practitioner, at this time, to conduct independent research for the good of the profession.

3.11 Consecutive Case Series Using the N=1 Model

Like the 'biomedical consecutive case series', an N=1 case series involves repeating single case studies on several individuals (French et al 2001; Guyatt et al 2000) and consolidating the data to form a 'series.' An inconclusive RCT N=1 study by Wegman et al (2005) studied the effect of temazepam, a sleep medication, on 15 individual patients. Five pairs of treatment consisting of one week of 10 mg of temazepam and one week of a control intervention—either a placebo or 10 mg of temazepam, were given to each individual in a randomized sequence. Outcome measures involved time to fall asleep and the individual's main complaint. The effects of temazepam was not consistent between patients. The study did not reveal if the patients were eventually informed of treatment versus placebo periods. However, seven out of the 15 patients had stopped or reduced their temazepam use, suggesting value for those motivated to stop or reduce their use of the medication (Wegman et al 2005).

Another study, with techniques that have raised protest among the acupuncture community, involved a psychologist who utilized the RCT N=1 model on 14 individual patients for tension headaches. A standard acupuncture treatment was devised for all patients from a standard Chinese text (Vincent 1990). The control treatment, administered at random intervals, consisted of minimal sham acupuncture—a technique using light, surface needling at non-classical point locations (Vincent 1990). Amongst the acupuncture community this 'sham' technique is expected to result in acupuncture effects (Birch et al 1999) because of complex physiological responses as receptors are stimulated in the skin (Lundeberg et al 2007). Vincent's study, for statistics, used a time series

analysis, which highlights cases in which strong effects follow immediately from treatment, theoretically indicating the presence or absence of a causal relationship (Vincent 1990). This method of analysis would not account for transient clinical effects (Mills et al 2000) in which symptoms may initially worsen before they improve, as part of the body's detoxifying process. Acupuncture, like many CAM interventions, often depends on a number of treatments for the full benefits to manifest (Jackson et al 2006). Consequently, Vincent's statistical results, although positive, did not reflect the even more sizable positive effects the treatments had produced, in both reducing the number of tension headaches for the patients and their use of medication, both shortly after the designated treatment period and on a four month follow up (Vincent 1990). Furthermore, Vincent himself was neither an acupuncturist nor seemed to contact a member of that profession either initially, to design the study, or for further interpretation of the results. Thus, little credit is actually given to acupuncture for patient improvement. A later acupuncture trial by Jackson et al (2006) went onto develop the N=1 trial into a valid model for acupuncture, using the pre-and post-test model. This model will be discussed in section 4.1.4.

Table 1. Summary of Author's Conclusions Concerning N=1 for the Herbalist Case Study

N=1 Model Option	Philosophically and logistically viable in practice?	Currently viable for scientific herbalist case study research?
AB	Yes	No
ABAB	No	No
ABABCAC	No	No
ABAB RCT	No	No
Pre-/Post-test	Yes	Yes

3.11 Summary and Conclusion

In recent history the case study has been seemingly downgraded due to the introduction of EBM's evidence hierarchy. Yet the case study has an important place in history, medicine, research and herbalism. The scientific method requires that research is properly recorded for future replication. This author investigated and ruled out the use of biomedical case series, involving medical testing and exclusively statistical analysis of results. Exclusively qualitative case study methods from the social science community were also eliminated as a viable method for the everyday practicing herbalist to participate in research. Considerations of internal, external and model validity were explored, including the use of RCTs for CAM research. The author described and critically reviewed various N=1 models for their possible use in herbal practice. The author ruled out the AB model as poor research. the ABAB withdrawal N=1 RCT, as well as variations on that model, such as the ABABCA model were considered for herbalists and eliminated, considering time and financial commitments, as well as the inappropriateness for herbalists of withdrawal, controls, complete blinding and placebos. The N=1 pre- and post- test study, used for multi-patient studies in CAM, was suggested as a possible option for herbalists and will be discussed in the next chapter.

4. REVIEW OF THE LITERATURE AND CRITICAL APPLICATION

Although the conventional medical community has easily adopted the ABAB model, it has already proven itself philosophically and logistically complicated and possibly inappropriate for herbalists. Another model must be found that recognizes the uniqueness and complexity of herbal protocols from practice.

4.1 Study Preparation

4.1.1 Define and Focus the Research Question

The defining characteristic of a case study is that it focuses on just one instance of the thing that is to be investigated (French et al 2001). Methodological appropriateness depends foremost on the research question (Verhoef 2007; Giacomini 2001). Vickers recommends that the researcher begin with a simple question (Vickers 2002). Perhaps the simplest question is whether an herbal treatment is effective in a given case. This, of course, begets the question of how *effectiveness* is defined. Most simply, we may ask if the treatment target(s), defined by the patient and practitioner (Guyatt et al 1988; Verhoef et al 2005), have been improved.

4.1.2 Define the Audience/Reader

A further question might be appropriately asked: 'For whom is this study being designed?' If it is for the client and practitioner alone, the case is likely to be an open, unmasked, before and after study, as in real clinical practice (Guyatt et al 1988). The AB model is often utilized, without rigorous methodology. The herbalist and client observe if the treatment has been effective and treatment is either continued, discontinued or

changed. However, if the herbalist would like to publicly disseminate research from clinical herbal practice, either to educate students, other practitioners, or to inform the biomedical community, a more consistent protocol should be followed.

4.1.3 Define the Purpose of the Research

The study purpose may concern the best practices for an individual patient, as it has been used in biomedicine (Guyatt et al 2000). However, if the trial is conducted for public dissemination, the researcher should be fully aware of why they have chosen a particular case (French et al 2001), which questions they are trying to answer, which questions they are choosing to ignore and why.

A case might be used to demonstrate treatment of an unusual disease or unique study population (Janosky 2005) or unusual use of a particular herb. These might be of interest to other practitioners or students needing to learn how to address unusual situations or less frequently used herbs where information from a larger scale study would be unlikely. Alternately, it may be used to generate a body of research to demonstrate the common use of a particular herb, for example. This may serve as foundational evidence leading to larger scale, funded research (Jenicek 2001).

Cases can be theory building, if they support common use of a particular herb, for example. Mills et al (2000), basing suggestions on the work of Diesing (1973) and Reason et al (1981) suggests a form of grounded theory, in which practitioner, patient and researcher provide observed data concerning the treatment, to provide as many views as

possible. Then these observations are cross-checked and recycled through formal content analysis and combined at a 'case conference editorial discussion' (p. 93). In a case series, each case would be individually studied in this manner and further conferencing of content analysis is recommended to see whether a pattern occurs in order to assemble a case series. This is a well-recognized technique in qualitative research. However, this author does not recommend or build upon this method, as she is advocating a simpler case study technique which would allow the average individual practicing herbalist, with little formal education in research, to begin research. Mills et al (2000) admits that this is a daunting process to most practitioners and would best be carried out in a training clinic where support, both academic and administrative, would be readily available. That said, The School of Scottish Medicine is currently trying to develop a pool of research expertise within herbalism, publishing the results of herbal research in *The Journal of Contemplative Medicine.*

In contrast, a case can also be used to refute assumptions (Janosky 2005), in the herbalist's case, about a particular herb's use. Jackson et al (2006) demonstrated improvement utilizing acupuncture for tinnitus, in response to poor, previously published studies that suggested lack of effect for the same treatment.

4.1.4 An Example of an N=1 Multi-Patient Trial Using Complementary Medicine

Jackson et al (2006) have demonstrated a seemingly effective multi-patient N=1 single-subject design utilizing an 'AB' pre- and post-testing quasi-experiment (French et al 2001) to examine change in complementary medicine. Patients were recruited who had a

standard medical diagnosis of tinitus. A daily diary and two quality-of-life questionnaires were assessed by the six recruited study participants beginning at two weeks prior to treatment (phase A). Each patient-participant was given an individualized Chinese medicine diagnosis and treatment. Each treatment, as is common practice in complementary medicine, was adjusted at each ongoing session of treatment based on changes of the presenting symptoms over time. Treatment is essentially zero phase. In the pre-and post-test study, phase (B) is post-treatment. Further assessments were recorded by the patient-participant post-treatment (phase B) at two-week intervals, finishing six weeks after treatment. In this AB design, the 'B' phase is post treatment, rather than during the treatment itself. Change was assessed through diaries and quality-of-life measurements. The usefulness of Jackson et al's study lies in providing an N=1 model in which a complete package of individualized treatments, allows for and accepts the reality of confounding factors such as the patient-practitioner relationship found in holistic practice. This study was carried out with an experienced researcher, statistician, and an everyday practitioner, providing a model for future researchers. The participants were chosen for a chronic but easily definable diagnosis of tinnitus. Clients, in real-life practice may present with multiple health conditions. The study was also limited in that study of six patients could not be generalized to the broader population. The researchers advocated that a larger study be performed (Jackson et al 2006).

4.1.5 Foundational Research

The pre- and post-test method circumvents many dilemmas for herbal medicine research, found in the more common withdrawal design previously discussed in section 3.8.2-3,

utilized by conventional medical practitioners. Jackson et al (2006) conducted a multi-patient study. This author recommends that initially individual herbalist-researchers study only a single subject in practice until a strong protocol is developed. The case series would involve replication of the N=1 protocol.

4.2 Some Considerations for Herbalist-Researchers

4.2.1 Prospective or Retrospective Studies

All previous published N=1 studies within the behavioral sciences, biomedical and CAM community, that this author was able to access through the various databases, were prospective studies. A prospective study design facilitates replication and internal validity. Replication of research results is an important means of establishing the reliability and generalizability of research findings (Kearns 1986). It may be argued that prospective studies might be open to bias because the researcher is 'choosing' the client, but this author argues that ultimately it is unknown whether a new client-participant will react positively to future herbal treatment. Consequently, the results may or may not confirm the benefits of herbal treatment.

On the other hand, if a researcher were to utilize retrospective studies, that researcher may be better able to bias the results by choosing the 'best' cases to prove the point of their study. Furthermore, retrospectively 'recording' exact levels of improvement, by either the herbalist-researcher and/or client would be based on memory. It is commonly understood that memory changes over time and thus would be a poor method to record the exact experience of the treatment, resulting in poor research. It is possible that a

practitioner may naturally take fastidious notes with scales of various sorts, for his/her own records and that this might yield useable data. Thus, while a practitioner may attempt to publish such data, it may not be well suited to an N=1 study, as a retrospective N=1 has yet to be published. A prospective N=1 case study method may be more appropriate for the beginning herbalist-researcher.

4.2.2 Inclusion and Exclusion Criteria

Inclusion and exclusion criteria must be determined, in advance, for the desired study participant. The question to be studied will determine some specific characteristics. Generally willingness and enthusiasm are desirable and will increase the likelihood of sustained patient-participant involvement (Vickers 2002).

The client should have a stable, long-term, chronic imbalance, whether a single disease or condition, such as knee pain, or a complex, multi-illness condition, such as a client with depression, lupus, dysmennorhea, and Raynaud's syndrome. The main concern is that the condition(s) does not vary much, improving or declining because without stability, change cannot be demonstrated convincingly. Each herbalist-researcher will establish his/her own diagnostic criteria for study inclusion. Highly variable conditions (e.g., very irregular flares of eczema) and acute conditions (e.g., a head cold) would be possible ineligibility criteria for study participation.

Janosky (2005) argues that external validity will be increased if the patient is chosen for his or her representativeness of the more common presentation for the particular

condition and/or herb(s) being utilized. Again, replication across researchers, patients-participants and practices would, in theory, enhance external validity (Janosky 2005). However, an experienced researcher at the University of Minnesota argues that independently conducted N=1 studies will not easily contain similar enough outcome measures or variables needed to create a database that could establish external validity (C. Garcia, personal communication, 2007). Thus, this author suggests that 'generalizability' of the patient not be a consideration for the study.

4.2.3 Ethics of Research

An informed consent process, documented in writing, should inform the patient of the purpose of the study, potential risks, and benefits, if any (Hart 2001). The patient should be aware of study details including confidentiality, his/her freedom to leave the study at any time without consequences, and that withdrawing will not jeopardize treatment or the practitioner-patient relationship (Irwig et al 1995). Informed consent is ethically critical to the integrity of research and should be described in any disseminated summaries.

Because N=1 reflects real-life practice, some researchers argue that it is not necessary to have an ethics committee approve the study (Irwig et al 1995). In contrast, Giacomini et al (2000), writing on behalf of the EBM working group, states that all studies involving human participants need to be approved by an ethics committee. Herbalist-researchers will need to contact an ethics committee within their own professional organization to ensure that approval can be sought and obtained prior to commencing any formal research. Resources such as the online Collaborative Institutional Training Initiative

(CITI) are available to researchers, with an option for independent researchers to receive training in the responsible conduct of research. It should be noted that study findings will not be published in a peer-reviewed journal if ethics committee approval was not obtained.

4.2.4 Mixed Methods: Utilizing Both Quantitative and Qualitative Data

A mixed method of quantitative and/or qualitative measurements may be used in the N=1 study (French 2001). The use of both objective and subjective measures contribute richness and internal validity to the study (French et al 2001; Verhoef et al 2005), allowing a more holistic approach. Quantifiable physical signs, measures of patient performance and lab tests, if available, might be used. Self-administered patient diaries measuring certain symptoms, simple questionnaires or rated Likert scales for quality-of-life measurements, focusing on issues such as sense of well-being have been developed and may be translated into quantitative data (Guyatt et al 1988). The patient might be asked to identify his or her most troubling symptom or problem, adding to the participatory nature of the design as a cooperative venture (Guyatt et al 1988), further encouraging the continued participation of the patient, as the patient would feel that their particular concerns are also the concern of the study. Patient and practitioner could negotiate the best schedule for the patient to record their experiences such as daily or weekly. Patients should rate their experience at least two times during the period being studied with the same outcome measures (Guyatt et al 1988).

Criticism has been raised about the routine practice of reducing qualitative issues into quantitative variables (Giacomini 2001). Qualitative research often involves exploring information and its meaning. Often its aim is to delve beyond appearances into the social phenomena behind the results (Denscombe 2003). Labels and stereotypes for qualitative and quantitative data are often oversimplified and misleading. Both types of information contribute to knowledge. Appropriate utilization may allow them to complement each other, rather than compete (Giacomini 2001).

Real-world research enhances external validity (Verhoef et al 2005). Within holistic research, it is recognized and accepted that patient and practitioner perceptions and expectations are intertwined with and affect the therapeutic process (Verhoef et al 2005). Indeed, the WSR philosophy emphasizes that people involved are expected to participate in the research (Ritenbaugh et al 2003). Whole systems are defined as whole bodies of knowledge and practice which use particular philosophies and modalities in order to maximize the mental and physical health and balance of their patients (Verhoef et al 2005). Qualitative methods examine patient experiences and the patient's subjective view of why and how they are responding to treatment (French et al 2001) to increase model validity.

4.2.5 Audience and Purpose

Descriptive prose, often used in qualitative research, would be an appropriate adjunct to supplement an N=1 study in herbal medicine. The researcher must not assume readers are familiar with herbal medicines or the practitioner's individual style of practice. Herbal

medicine has several schools of thought, ranging from a scientific approach, utilizing information from scientific studies and the chemical constituents of plants (Mills et al 2000), to a very folk-medicine approach, based on experience with local plants and traditions, such as the work of Tommie Bass in Appalachia (Crellin et al 1989). In between are practices with differing paradigms and styles such as Native American, the Eclectics, Ayurvedic Medicine and Chinese Medicine. Within each of these are further variations. For example, a multi-patient N=1 study involving Tai Chi described the general philosophy of Tai Chi and gave further description surrounding the particular type of Tai Chi being studied (Chen, Hsu et al., 2007). Descriptive illumination of practice philosophies in herbal research would allow the treatment to be assessed within its own unique explanatory model (Verhoef et al 2005). For example, Ayurvedic practitioners might describe the concept of the *doshas—pitta*, *vata*, and *kapha*—and the method of balancing lifestyle and utilizing herbs, even as food, in order to restore tridoshic balance (Lad 2002). In contrast, Chinese medicine practitioners might chose to only describe the basic concept of balancing *yin* as cooling and moist, and *yang* as hot and dry, in order to move *qi*, or energy, to restore harmony within the body (Maciocia 1989). Another Chinese medicine practitioner might choose to elaborate on organ system imbalance by focusing on the 'five element theory,' (Maciocia 1989) if it is important to understanding the case study they are promoting as research. An example of this for Western herbal medicine from this author's practice is explained in section 4.3.1. The degree of detail that each practitioner chooses to include may also be determined by the expected or hoped-for audience and those readers' familiarity with the particular practice philosophy.

4.2.6 Outcome Measures

The outcome measures must be chosen before treatment commences. For the purpose of an individual case study, or an N=1 case series tied around a particular theme, to remain consistent, it is important to maintain consistent measurements and not switch evaluation methods during that single- or multi-case study, otherwise the measurement data would be considered incomplete and inaccurate. The discussion section of the individual study may provide suggestions for future studies to improve outcome measurements.

There are several aspects to an herbal treatment protocol that lead to many different types of research questions, yet only some can or should be investigated in a single study (Hart 2001). Outcome measures should be chosen following consideration of their relevance to the philosophical underpinnings of the intervention itself (Verhoef et al 2005). To record patient perception of change in herbal treatment, outcome measures should record health gains in a broader way than exclusively recording symptom reduction. For example, herbalists might expect other aspects of a client's being to be impacted by treatment, as herbs often affect the body, mind and spirit (Mills 2000) although the client may be primarily concerned with a particular symptom, such as hot flashes. These types of outcome measures help inform the paradigm fit between treatment and outcome (Verhoef et al 2005). Broader measures may also help explain why client perception of herbal medicine is positive, even when RCTs do not show herbs to clearly or rapidly eliminate a specific symptom or disease state.

Outcome measurements should be relevant and meaningful to the patient, practitioner and the question being asked. For example, a scale that measures only physical function may be inappropriate for a study of depression. Yet, in the case of depression, a scale that includes energy levels or sleep satisfaction, alluding to physical function, would likely be considered appropriate. Indeed, physical function is often included in internationally approved/validated scales assessing depression.

Chosen outcome measures should be previously validated in prior research with similar study populations whenever possible; if these measures are being created by the herbalist-researcher s/he may benefit from consultation with a statistician (Bowling 2005). Measures should be easy to understand in order to maximize compliance (Bowling 2005). Self-reporting measures, such as patient diaries, will reduce concerns of bias (Bowling 2005).

This author believes even validated outcome measures will need to be carefully considered because measures are often validated for specific populations (e.g. age, ethnicity) that may or may not be translatable. For example, researchers using a new validated pain scale during a multipatient quasi-experiment to study the effect of therapeutic touch on the chronic pain of fibromyalgia found that there was no accommodation for an explanation within the outcome measures for the acute pain of a kidney stone and migraine experienced during the study by some of their participants (Denison 2004). The pain scale reflected an increase in pain unrelated to the actual condition under study. Even a scale that measures simple well-being may be inaccurate if

outside events, beyond the treatment the patient has received interfere, such as has happened with studies during various significant political events (Denison 2004; Chen, Li 2007). Positive circumstances might also influence the patient-participant, such as getting a promotion at work or inheriting money.

For herbal medicine treatment, transient clinical effects should be considered when determining the frequency of recording outcome measures. For example, if experienced herbalists have often noticed an aggravation of symptoms shortly after adjusting remedies at each appointment, they may chose not to have outcome measures recorded shortly after visits. Then again, frequent data points, displaying initial aggravations, may be considered, by the herbalist-researcher, informative to readers concerning the healing process. Again, considerations will be based on the purpose of the study. Herbalist-researchers may choose to record infrequent data points, such as at baseline (before treatment commences) and post treatment (after the treatment has been completed) as other CAM studies have chosen (Chen, Li et al 2007; Taylor-Pilae et al 2006; Vitale et al 2006; Wilkinson et al 2002), in order to demonstrate the efficacy of the complete treatment package.

4.2.7 The Recording of Data

Record keeping for data compilation purposes must also be considered in advance. If the N=1 study is exclusively for best practice for the individual patient, outcome measures may be exclusively measured with visual analysis, to inform only the patient and practitioner. Charts in the behavioral sciences have historically been used to document

improvement or decline (Kearns 1986). Within the medical establishment, charts are considered open to bias (Gliner et al 2000). With the advent of easily accessible statistical computer systems there has been a strong emphasis on statistical analysis to document the efficacy of treatment (Gliner et al 2000). Statistics provide data for inference. However, the single-subject design often does not provide sufficient quantities of data for appropriate statistical inference (Janosky 2005). Furthermore, the statistics for data provided by the N=1 design lack power unless they are in sufficient quantity (Guyatt et al 1988).

There is a great difference of opinion concerning the appropriate statistical analysis for the N=1 study (Campbell, 2004). Different studies use and recommend different methods (Campbell 2004; Gliner et al 2000; Guyatt et al 1988, Jackson et al 2006; Janosky 2005; Larson 1990; Newcombe 2005). The author, as herbalist, recognizes that most herbalist-researchers, for statistical analysis, will need assistance from experienced statisticians, due to the lack of standard statistical protocol regarding N=1. Concerning future combining of individual cases into series, Verhoef et al (2005) acknowledges that an innovative statistical methodology will be needed in order to address the individualized data generated by small-scale studies. In addition to statistics for the larger medical community's acceptance of the study, dissemination within the herbal and lay community may require charts for the easy comprehension of those readers unfamiliar with statistics. This author advocates the use of both visual charts and statistical analysis, to strengthen the presentation of the study results for all audiences.

4.3 The Study Method

4.3.1 Treatment Protocol

To strengthen the 'model validity' or the 'paradigm fit' (Verhoef et al 2005) for the whole systems model of the N=1 study, a double classification of diagnosis within both the conventional and the particular herbal model should be used (Mills 2002; Verhoef et al 2005). Conventional medicine has a clear classification system for disease diagnosis (Wiegant et al 2002). Herbal diagnosis, as noted before, varies depending upon the type of herbal practitioner. Consequently, beyond the practitioner's diagnosis, a description of the unique healing theory behind the diagnosis and treatment would help validate the treatment within the context of its own system (Verhoef et al 2005).

For example, this author might describe her own system of herbalism for a case study as such:

> The herbalism utilized in this herbalist's practice is based primarily on the belief of the innate ability of the body to right itself if 'flow' is restored within the body. In order for each cell, tissue and organ to properly function they need to receive nutrition and expel waste. If the body is not properly 'flowing', areas of congestion appear that will manifest in illnesses including, but not limited to, kidney stones, gallstones, blood clots, swollen lymph glands, sinus congestion, headaches and pain. In order to reestablish flow within the body, this herbalist bases her practice on the tissue state work introduced by the physiomedicalists (Cook 1869 reprinted 1998) and taken up by modern-day herbalist Matthew

> Wood (2004). The body is lined with tissue. The simplest way to see the health of this tissue is through the tongue. If the health of the tissue is out of balance—that is, too hot, too dry, too wet or too cold—it will not allow the tissue to 'flow' properly in order to bring nutrients and remove waste from the body tissue. Herbal remedies are chosen for their ability to counter the imbalanced tissue state—for example, using a cooling remedy to address a heated tissue state.

This author would then further elaborate upon this concept within the 'intervention' section of the particular study, as it is applies to the herbal remedies chosen during the case. This is a brief explanation of this author's theoretical framework. Depending upon the audience, publication venue (e.g., herbal or non-herbal) and relevance to the case study, the length and detail would vary.

4.3.2 Pretesting

Baseline (A) is recorded as the patient assesses the outcome measures for a predetermined period of time, prior to treatment. This may be accomplished by using patient diaries, self-report questionnaires, or visual scales. The same outcome measures must be recorded in the pre- and post-testing data (French et al 2001). The baseline records any variability within the patient's target treatment areas and overall condition, such as well-being. Longer baselines increase the internal validity of the method, as they counter arguments that the treatment success or failure was merely due to normal biological healing or deterioration, therefore producing a false positive or negative treatment effect (French et al 2001). Jackson et al (2006) used a two-week baseline. This

author believes that this baseline was adequate for the condition of tinitus, which was a daily occurrence for the participants studied. It was also realistic, as a two-week waiting period for an initial treatment would not be uncommon in real-life practice.

4.3.3 Treatment

Treatment commences. Upon follow-up visits, treatment protocol may change in accord with normal treatment practices. Internal validity will be strengthened by holding as many factors constant as possible, such as the setting, time of day, the attending practitioner, or additional conventional medications. If these factors change, it should be noted for future researchers, as the changes may affect the validity and replicability of the study. For example, a patient is being treated for daily headaches and the herbal treatments appear mildly effective in reducing headache frequency and intensity. In week two, the records suddenly show a marked decrease in frequency and intensity of the headaches. If it was not recorded that the patient had begun to take pharmaceutical pain-killing medication at this time, it would appear that the herbal treatments had increased in efficacy, which would be an inaccurate reflection of the treatment effect. Researchers may prepare, in advance, to have the patient record any factors that may have changed during the course of treatment, such as medication or diet, as part of the outcome measures, at regular intervals during the treatment. The researcher may also collect qualitative data by asking the patient to respond at regular intervals to open-ended questions embedded within the outcome data.

Duration of the treatment is flexible, as it is in normal practice (Guyatt et al 1988). Naturally, it will depend upon what is being addressed. However, if it is a condition that has periodic exacerbations, such as headaches related to the menstrual cycle, it is recommended that the treatment last three times longer than the typical cycle of exacerbation (Guyatt et al 1988). In the previously mentioned example, three months might be considered an appropriate duration for this particular study. Although the duration of treatment is said to be flexible, in order for later statistics to be properly analyzed, a predetermined duration of treatment is necessary for each individual study (Gliner et al 2000). This author, having practiced herbalism for 13 years, believes that this would be an adequate time period to demonstrate change within the patient's condition, for this particular example. As stated previously, the particular research question and individual herbalist-researcher will determine the length of the study, depending upon numerous factors such as the time the herbalist-researcher believes is needed to properly address the condition(s) or herb(s) being studied, as well as individual patient characteristics.

4.3.4 Post-Treatment

Outcome measures are now recorded at regular intervals during the 'B' or post-treatment phase, recording overall effects of treatment on the various predetermined treatment targets. Jackson et al (2006) had patients record the outcome measures at two week intervals for six weeks (3 measurements). Recording of post-treatment phase experience may be recorded longer if the normal exacerbation of symptoms were at extended intervals, such as the menstrual headache example cited previously. In the example of a

monthly exacerbation of menstrual headaches, outcome measurements would be recorded monthly for three months to record consistent change. Ultimately, time frames for each study would be determined by the particular condition(s) and/or herb(s) being studied.

4.4 *Considerations for an N=1 Case Series*

An N=1 case series is simply a combination of individual N=1 studies. To turn an N=1 case study into a case series, the purpose, question, baseline, length of study, outcome measures and post-treatment period should all be similar, if not exactly the same (C. Garcia, personal communication, 2008).

4.5 Conclusion

4.5.1 The N=1 Model for Herbalist-Researchers

The EBM Working Group in 2000 has stated that 'Any empirical observation about the apparent relationship between events constitutes potential evidence' (Guyatt et al 2000 p. 1292). The N=1 trial, developed by the behavioral sciences community, has been transformed into the N=1 RCT for the practicing physician. This model is not easily transferable to the complementary medicine community, particularly herbalists. A simple system of pre- and post-testing, utilizing the N=1 model, is currently being utilized in CAM to research the efficacy of holistic care, as demonstrated by the ease of accessing studies in various databases (Brady et al 2001; Chen 2007; Chen et al 2005; Crawford et al 2006; Denison 2004; Drexler et al 2002; Jackson et al 2006; MacMahon et al 1998; Malmgren et al 2001; Taylor-Piliae et al 2006; Vitale et al 2006; Wilkinson et al 2002). No herbal N=1 studies were found. The quantity of published studies suggests that this

method is considered both valid and valuable as a method to study the effects of holistic medicine. A mixed method of quantitative and qualitative data, as advocated by Whole Systems Research, will provide context for the herbal system being utilized, as well as the treatment and its results. A scientifically strong and accessible model for the N=1 case study, and by replication, case series, can be developed, using the pre- and post-test protocol, for practicing herbalists to contribute to research for students, colleagues and may also serve to inform the biomedical community, thereby increasing the regard of professional herbalists.

4.5.2 Author Assumptions

Within this model design, this author assumed that the herbalist-researcher is a busy practitioner, not particularly well versed in research methodology or statistics. This author also assumed that it is best to start simply in research with one client before studying multiple clients. This author assumed that busy practitioners will not be willing to spend large quantities of time or money on their research if they are performing it only for the good of the profession or to educate other practitioners. This author also assumed that an N=1 model is preferable because the practitioner will not have an identical 'control' client at their disposal, willing to bypass or postpone treatment.

4.5.3 Limitations of this Study

This author cannot predetermine the outcome measures for unknown conditions or herbs yet to be studied, and is therefore beyond the scope of this paper. It is also beyond the scope of this paper to determine appropriate charting or statistical measures that will best

illustrate and analyze the details of all future studies with varying conditions, herbal formulas, outcome measures, and study periods.

4.5.4 Limitations of the Pre- and Post-Test N=1 Study

Change may still be attributed to factors other than treatment. It is still possible that time and maturation my have resulted in any change in the treatment targets' status. French et al reminds us that change may also have occurred due to outside factors that were not part of treatment, such as a change in diet because of exposure to mass media (e.g., reading a newspaper article) or outside political events, not discussed with the practitioner (2001). N=1 studies, being limited in size, are not generalizable to a broader population (C. Garcia, personal communication, 2008).

Chapter 4 has critically evaluated options for an N=1 case study design for herbalists. Chapter 5 will discuss the resulting synthesis and its application for future herbalist-researchers.

5. RESULTS AND ANALYSIS OF DATA

The purpose of this author's study was to develop an accessible, scientifically sound design to study individual herbal cases in practice, which may eventually be compiled into a case series. Previous N=1 designs adopted from the behavioral sciences and integrated into biomedicine and complementary medicine were synthesized to produce a viable N=1 design to study herbal medicine. In this chapter this author presents a model that is scientifically sound, yet feasible, for a practicing herbalist. This model has not been tested in a pilot study.

This chapter is separated into three parts to present this author's findings on the model an herbalist researcher could employ to carry out a single case study utilizing the N=1 design: (a) designing the research study, sections 5.1-5.6; (b) doing the research and collecting data, section 5.7; and (c) writing up the research, section 5.8. An N=1 case series is simply a combination of those individual studies.

Table 2. Executing the N=1 Research Study

Designing the Research Study	
Pre-Study	• Define the purpose of the study • Conduct a literature review • Focus the research question • Consider outcome measures • Consider the future documentation of data, including treatment duration • Get ethics committee approval • Identify participant qualities • Recruit participant • Obtain informed consent

Doing the Research	
Pre-Treatment	• Complete intake forms • Record baseline data • Duel diagnosis of client
Treatment	• Client-Participant receives herbal treatment • Document treatment protocol
Post-Treatment	• Remind client-participant of data collection • Collect data at predetermined intervals • Finish collection
Writing up the Research	
Data Analysis	• Visually and statistically analyze • Analyze qualitative data
Dissemination	• Write up results

5.1 Designing the Research Study

The author of this paper is encouraging that N=1 studies be publicly disseminated, hopefully through publication. Thus, recommendations will be oriented toward this goal.

5.1.1 Define the Purpose of the Study

The herbalist-researcher should be fully aware of the reasons for choosing a particular case (French et al 2001), which questions he or she is trying to answer, and which questions he or she is choosing to ignore (e.g., the limitations of the study) and why. These elements should be stated clearly in the published research (Hart 2001). A literature search, described in section 5.1.2 will also help to define the question.

Table 3. Define the Purpose of the Study

Purpose of the research	Research Question Example
Demonstrate the common use of a particular herb	'Is *Leonurus cardiaca* effective in the treatment of perimenopausal symptoms?'
Demonstrate the use of an uncommon herb	'Does *Oxalis spp.* effective in the treatment of mood disorders?'
Demonstrate the efficacy of herbal treatment on a common condition	'Is herbal treatment effective in reducing the "pain" of arthritis?'
Demonstrate the efficacy of herbal treatment on an uncommon condition	Are herbs effective in reducing the pain of anterior cruciate ligaments tears?'
Demonstrate the efficacy of herbs on chronic conditions that are difficult to treat	'Is herbal treatment effective in reducing tinnitus?'
To refute assumptions	'Are drop doses effective in the treatment of hot flashes?'

Highly variable and acute, short-term conditions (e.g., a head cold, or a recent eczema outbreak) would be probable exclusion factors for study because a stable baseline could not be established, and the condition would be expected to resolve itself, for the most part, over time, thus not clearly demonstrating the effects of the herbal treatment.

Regardless of the purpose, question and dissemination venue, a replicable research protocol should be utilized.

5.1.2 Conduct a Literature Review

Sometimes the question evolves out of a problem the herbalist-researcher has observed in practice, for example, observing a seeming lack of effective treatment for a particular condition within the biomedical community, such as irritable bowel syndrome. The

herbalist-researcher may want to document an herbal case concerning that same condition. It is valuable to conduct a literature review regarding the research question and condition to identify existing knowledge and gaps.

5.1.3 State the Research Question

Based on findings in the literature and the researcher's interests, a research question is formulated. Questions of treatment effect are relevant for the practicing herbalist. A clear and simple question will be helpful in defining limits for the study. 'Is herbal treatment effective in practice?' although a simple question, is actually quite broad and hard to define. The question should boundary the study. It is necessary for the researcher to home in as closely as possible on a question that is both focused and narrow.

In the above example, the word *effective* is focused, but is too broad to be useful. Some examples of focused, narrow research questions are presented below.

1. *An herbalist may want to demonstrate the common use of a particular herb*. This question might be applicable to herbalists who tend to use 'simples', or single herbs, such as this author and her mentor, Matthew Wood. If this author wanted to broadly apply *Leonurus cardiaca's* use in the reduction of perimenopausal symptoms she might ask 'Is *Leonurus cardiaca* effective in the treatment of perimenopausal symptoms?' and then focus on a small set of symptoms associated with perimenopause, such as menstrual irregularity, irritability, and insomnia. This author commonly uses *Leonurus cardiaca* for the treatment of hot

flashes with heart palpitations. Thus she might phrase the more simple question; 'Is *Leonurus cardiaca* effective in the reduction of hot flashes with heart palpitations?' This question is very specific, but possible to undertake and appropriate to herbalists who tend to use simples and want to establish initial descriptive research findings which can be built on with more complex experimental designs.

This type of study question can also be used by the more common herbalist who uses individualized herbal formulas to address health conditions. An herbalist who wanted to demonstrate the common use of an herb formula, such as 'Swedish bitters' for improved digestion might ask 'Are Swedish bitters effective in digestive function?' He or she might focus on issues of bloating and bowel function, defined by bowel transit time. The question could be even more focused, such as 'Are Swedish bitters effective in reducing digestive bloating and improving bowel transit time (or function)?' Studies of this type might serve to alert or inform the biomedical community of individual herbs that are effective for common conditions, leading to larger, funded studies. These studies could also inform the biomedical community of the efficacy of individualized herbal treatments from professional herbalists, thereby improving the herbal profession's status.

2. *An herbalist may want to demonstrate the use of an uncommon herb*. For example, this author used the 'doctrine of signatures'- that a plant resembles what it can be used for in the human body- to 'discover' the use of *Oxalis spp.* She has used this plant frequently in her practice for various mood disorders, particularly

depression. Yet, this plant, while edible, is not currently used in herbal medicine. But like the sunny expression of the plant itself, it seems to impart a sunny disposition. She would then ask the question 'Is *Oxalis spp.* effective in the treatment of mood disorders?' A study of this type could serve to educate the broader herbal community.

3. *An herbalist may want to demonstrate the efficacy of herbal treatment on a common condition.* This author has found herbal treatment to be effective for arthritis. However, each case tends to require different herbal remedies with different types of administration. Thus she would choose a question that did not focus on the herbs themselves, but on the 'general' efficacy of 'herbs' for arthritis. Her question might be 'Is herbal treatment effective in reducing the "pain" of arthritis for this client?' A study of this type could serve to educate the biomedical community about the effectiveness of herbal treatments in common conditions. Effectiveness would be measured by both qualitative and quantitative outcome measures discussed in sections 4.2.6 and 5.1.4-6.

4. *An herbalist might want to demonstrate the efficacy of herbal treatment on an uncommon condition*. For example, this author has found herself effective in eliminating the pain of torn anterior cruciate ligaments (ACL). Thus, she might pose the question 'Are herbs effective in reducing the pain of ACL tears?' Because of her abilities, she has received many referrals to treat this condition. A case study or series would be of interest to herbal students and peers.

5. *An herbalist might consider demonstrating the efficacy of herbs on chronic conditions that are difficult to treat*, in either herbalism and/or the biomedical community, such as tinnitus. The question might be stated as 'Is herbal treatment effective in reducing tinnitus?' A study of this type might be useful information for either or both the herbal and biomedical community.

6. *A case could also be used to refute assumptions*. For example, this herbalist utilizes 'drop doses' in her practice. She recognizes that many herbalists do not believe that one to three drops of tincture could be effective. Standard recommended doses, as seen on tincture bottles in the U.S., is 30 to 40 drops, per dose. Thus, the author might choose a common or uncommon herb and a common or complicated disease condition and utilize drop doses in her treatment. She might pose the question as 'Are drop doses effective in the treatment of hot flashes?' This type of information could be used to inform the broader herbal community of the efficacy of drop doses.

5.1.4 Outcome Measures

To measure the effects of treatment, outcome data may include both qualitative and quantitative measures. Data collected will be determined by the type of study and should be approved by the IRB prior to the study. Measures may be assessed in the clinic, administered by the practitioner. However, taking this approach would allow claims of potential bias to ensue, if the client-participant were concerned with their relationship to the practitioner, for example. Self-administered outcome measures would reduce this

claim of bias (Bowling 2005). This author encourages the herbalist-researcher to use previously validated outcome measures. The Health and Psychosocial Instruments (HaPI) database provides detailed descriptions of outcome measures related to whatever condition is searched. Most measurement instrument must be purchased. Outcome measures would be repeated for each N=1 case study included in a case series.

5.1.5 Quantitative Data

When choosing outcome scales to demonstrate 'effectiveness' the herbalist-researcher must consider what aspects of the condition s/he is trying to measure. For example, in the earlier arthritis example, the practitioner must determine what is to be measured, for example, mental and social health, or exclusively physical symptoms, such as pain. In the example of hot flashes, questions surrounding frequency and intensity might be asked. Outcome measures should be easy for the client-participant to understand and complete, in order to increase compliance. An appropriate outcome measure for this situation might include a self-administered symptom diary with scale measures regarding treatment goals. The herbalist-researcher may choose to have the client-participant assess outcome measures daily, before or after each treatment, or at baseline (pre-treatment), midpoint, and at the end of the study (post-treatment). A University of Minnesota quasi-experimental design researcher has commented that statisticians like multiple data points for quantitative data, as it helps to demonstrate trajectories of improvement or decline (C. Garcia, personal communication, 2008).

5.1.6 Qualitative Data

Qualitative data is another way to demonstrate the effects of treatment and is frequently gathered at baseline, midpoint and the end of the study (C. Garcia, personal communication, 2008). Qualitative measures may include open-ended questions and can be embedded within the client-participant's self-administered outcome measures diary or completed at various clinic visits. Frequency should be determined by the herbalist-researcher as appropriate to the study question.

An open-ended question related to the client's perception of his or her condition at baseline and again at the final visit may be asked. Additional subjective data, such as the client's retrospective perception of their situation prior to treatment, might provide valuable and meaningful data concerning the extent of change possibly not recorded by the quantitative data. If the herbalist-researcher were to also record a written picture of his or her perception of the client, before and after the treatment period, it may provide objective data. The client may be asked to comment on their treatment experience. This may provide additional insight as to why herbal treatment is used by the public, despite a lack of scientific evidence. Because herbalists expect treatment effects to go beyond merely the quantified treatment target, a question may be posed as to whether the client perceives benefits of the herbal treatment beyond the condition for which they sought an herbalist. If qualitative questions are asked aloud, rather than written, this author recommends having a different researcher administer the questions to reduce issues of bias.

5.1.7 Confounding Factors

Factors that may affect and confound the results of treatment should be recorded. The herbalist-researcher could embedded questions in the written outcome measures, on a regular basis, perhaps at every treatment, or even into a daily diary, to note if the client-participant believes that additional factors may be affecting their response to treatment. The question could be stated as 'Do you believe that changes in any factors such as pharmaceutical medication, self-medication of additional herbs, supplements or other holistic treatments (e.g., massage), dietary changes (e.g., alcohol, sugar, dairy), personal or political events have affected your treatment results?'

In holistic medicine, it is often taken for granted, if not welcomed and expected, that the client-practitioner relationship affects treatment results. This said, it might be additionally useful, perhaps in the post-treatment results, to address this issue. The herbalist-researcher might embed a final question, whether in a post-treatment interview by another researcher, or within the client-participant's written outcome measures—'Do you feel that your relationship with your practitioner has affected your response to treatment in any way? If yes, please elaborate.' Qualitative data could also include the practitioner's perception of the relationship, as it may inform the reader concerning the negative or positive responses from the client.

5.1.8 Consider the Future Documentation of Quantitative and Qualitative Data

For instruments involving quantitative analysis, such as scaled outcome measures, the method of charting or statistical analysis should be decided before the study begins so that data may be properly gathered. Computer software is available for this purpose. This said, in reality, much controversy exists concerning the appropriate method of statistical analysis for N=1 studies (Campbell, 2004). Currently, almost every published quasi-experimental research design uses a different method of statistical analysis. Statisticians are valuable resources for quantitative analysis. This author recommends contacting outside resources for help in choosing the appropriate technique for analysis of the chosen outcome measures.

There are specifically designed computer software packages available for analyzing qualitative data. This said, analysis may require mentoring or collaboration with a researcher with prior experience and expertise in this type of research. Contacting a local university is recommended by this author. Contact with experienced researchers may lead to collaboration, aiding the future publication of the research.

5.1.9 Ethical Considerations for Human Subject Research

Giacomini et al (2000), writing on behalf of the EBM working group, confirms that all studies involving human participants need ethics committee approval by the Institutional Review Board. Even though an N=1 trial involves only one participant, care is warranted to assure anonymity and to assure that proper protocol is followed. A review of the study by an ethics committee provides opportunity for assuring protection of study participants

and gives the researcher opportunity to receive useful advice and council regarding the study protocol's measures taken to protect all participants. Within the study the researcher must note this approval and be able to provide documents, if requested.

Herbalist researchers who have the support of an academic institution should apply for ethics approval far in advance of their planned study, as ethics committees are compromised of volunteers and meet regularly, but not often. Independent herbalist-researchers will need to contact an ethics committee within their own professional organization. Ethics committee approval should be obtained before recruiting participants.

5.2 Identify Participant Qualities

Client willingness and enthusiasm for participating in the research process are desired traits that will contribute to the likely completion of the study. Inclusion and exclusion criteria should be established as well, identifying the boundaries for potential study participants. Patient-participants for the N=1 study are often chosen because they have a stable, long-term imbalance, either a chronic disease, such as fibromyalgia, and/or another conditions, such as tinnitus, hot flashes, asthma, insomnia, chronic low back pain, etc., in which the condition does not vary much, improving or declining. Cyclical conditions, such as pre-menstrual headaches, often come in expected timing patterns and may still be considered 'stable' conditions. Without stability no change can convincingly be demonstrated. The definition of stability for each particular study will pre-established as part of the inclusion and exclusion criteria. In the instance of any of the previously

mentioned study examples (Table 3), inclusion and exclusion criteria might include a minimum length of time (e.g., one month, one year) or frequency (e.g., hourly, daily, weekly) that the condition, such as hot flashes or tinnitus, has been experienced in order to participate in the study as well as willingness to participate in the research. For the example of arthritis, the herbalist-researcher must consider if the research would include all types of arthritis (i.e., osteo, rheumatoid, etc.), and if clients taking medication may be included or excluded. Other health conditions might be considered (e.g., if the client's condition is complicated by fibromyalgia or lupus, also causing aching in the joints) as possible inclusion or exclusion criteria. Inclusion and exclusion criteria must ultimately be determined by the herbalist researcher for their own study.

5.3 Recruiting the Participant

Three possible strategies for recruiting the participant will be addressed: (a) recruiting past or existing clients, (b) evaluating a new client as a participant, and (c) recruiting participants outside of the herbalist researchers' practice. All study participants will need to be screened for inclusion and exclusion criteria, as described in 5.2.

5.3.1 Identifying an Existing or Past Client

Herbalist-researchers' clients can serve as their study participants. An advantage of a retrospective study utilizing a past client is that data are readily available. For example, this author considers herself skillful at reducing muscular-skeletal pain. She might perform a clinical audit first to assess how she is recording data in case histories, which would give information on how she might extract data. For example, in chart review, this

author has recognized that she primarily records qualitative data, sometimes quoting her clients, yet she does not consistently ask the client to quantify his or her experience. Because the use of both quantitative and qualitative data strengthens the N=1 model, consistently gathering and recording both types of data would be necessary for retrospective research. This author, from all her work identifying qualities that strengthen an N=1 research model, considers retrospective studies for the N=1 trial weak, at this time.

A new client is ideal for an N=1 study. An existing client might be considered. However, a stronger N=1 study would record baseline data *prior* to treatment, whereas an existing client's baseline data, if recorded in retrospect, midway through treatment, might also be open to the bias of memory.

5.3.2 Evaluation of a New Client as a Participant

The optimal N=1 study uses a prospective approach and new clients would fit this requirement. It may be argued that prospective studies may leave the research open to researcher bias, as an herbalist-researcher may 'choose' the study participant. However, if data are recorded by the client-participant (i.e., self-administered daily diaries) and interview-type questions are conducted by a third, blinded researcher, this will help to allay concerns of bias. Furthermore, the raw data will be available for further inspection, if these concerns arise.

The study question will determine the speed with which the herbalist-researcher will acquire an appropriate client to study. If the question regards a plant commonly used or condition commonly seen in the herbalist-researcher's practice, that herbalist researcher may readily recruit from his/her new client base. On the other hand, if the herbalist-researcher is interested in studying a more obscure health condition or herb, some time may pass before an appropriate client, by chance, requests the herbalist's assistance. This situation may best be addressed by recruiting participants, addressed in section 5.3.5.

5.3.3 Screening Tools for New Clients

Following are two possible strategies for identifying new clients appropriate to the study.

1. *The use of screening tools*. A questionnaire, particular to the study, may be used either on the phone or at the initial consultation. Questions would pertain to the predetermined inclusion and exclusion criteria such as the condition for which the client is seeking treatment, how long the condition has existed, whether the client would be willing to participate in a research study to study the efficacy of herbal medicine, and informing the client that they would have to regularly fill out data forms to record their progress.
2. *Information provided in initial consultation*. If the client's condition suits the subject of the desired N=1 study, the herbalist would introduce the research and invite those eligible clients to participate.

5.3.4 Recruitment of Participants Outside of the Researcher's Practice

Although it is outside of the everyday practice, recruiting individuals who are ready and willing to participate in a study may be the most efficient way to identify possible study participants. It will also help ensure participant compliance if the client-participant has self-elected to contribute time and effort for the purpose of research. Word of mouth and low-cost electronic methods such as listservs could make the cost and effort minimal for marketing and recruitment.

5.4 Participant Incentives

Recruited participants might not have considered herbal treatment if they were to pay the full price, particularly because herbal treatment is often not covered by medical insurance. In addition, a broader socioeconomic cross section of the population may be included if costs were adjusted. Discount cost considerations might ensure the continued participation from a client-participant recruited for a somewhat unusual approach to a normal protocol. These may include an initial pretreatment waiting period and regular data collection (e.g., daily diaries) during and after treatment. An ethics committee will flag any suggestion of coercion and can assist in identifying an appropriate incentive level for study participants, which can help the new researcher amend any inappropriate recruitment strategies.

Incentives to promote study retention could be offered in the following ways:

1. A multi-treatment package could be offered at a discount when paid in advance. This would depend on the study purpose, length of study, study population, and so

forth. Brady et al's 2001 pre- and post-treatment study used this method successfully for recruitment and complete participant retention.

2. A free treatment could be offered to the participant at the final visit, after s/he completes and returns the various post-treatment outcome measures.
3. A small refund could be offered to the participant at the final visit, after s/he completes and returns the various post-treatment outcome measures.
4. Treatment could be free. There is a precedent of the practitioner contributing his/her time for free (Jackson et al 2006).

5.5 Obtaining Informed Consent

Before commencing research, the participant should be fully informed about the study and document consent to participate. A signed informed consent document indicates the client's receipt of information about the study and confirms willingness to participate. Important content covered in the informed consent process includes issues of confidentiality and the ability to withdraw from the study at any time without consequences to the treatment plan and/or relationship with the provider.

5.6 Baseline Data

In order to properly study the client's response to treatment, a baseline must be established before treatment. The longer the baseline, the stronger the study. Ethically, the herbal practitioner may be uncomfortable withholding treatment, while the herbalist as businessperson may be concerned with losing the client during the baseline period. Jackson et al (2006) utilized a two-week period to establish a baseline for the daily

experience of tinnitus. This author considers this time frame reasonable, although not absolute for every study, for a condition that is experienced on a daily basis, since a busy practice may book out this far for appointments. Ideally, baselines should accurately reflect a condition's aggravation cycle, such as menstrual headaches, or premenstrual syndrome (PMS). For example, to properly record a monthly aggravation of menstrual headaches or PMS, a waiting period of three menstrual cycles would be recommended (Guyatt et al 1988). In this example, a baseline of three months would be considered appropriate yet might also be considered inordinately long. A solution, given the constraints of doing research in real-life environments, is to collect baseline data at the initial consultation, asking the client to reflect on his or her past experience (C. Garcia, personal communication, 2008), although it may be argued that the baseline data would be biased by the weakness of memory. In the previously mentioned case of premenstrual headaches or PMS, the client-participant may record the type, frequency and duration of headaches, and/or PMS symptoms and degree, of the past three months. In the example of tinnitus, if the client-participant did not want to delay treatment two weeks, the herbalist-researcher could also ask that person to record their past two-week experience of tinnitus. In the case of a painful injury, such as an ACL tear, it would be expected to not delay treatment and merely measure baseline data shortly before treatment. Although long baselines are ideal, given the constraints of real-life research, it is a common feature of many quasi-experimental studies to have outcome data measured shortly before treatment (Chen, Li et al 2007; Chen, Hsu et al 2007; Malmgren-Olsson et al 2001; Taylor-Piliae et al 2006; Vitale et al 2006; Wilkinson et al 2002).

5.7 Doing the Research and Collecting Data

5.7.1. Pretreatment

After the initial screening pertaining to inclusion/exclusion criteria the client-participant completes forms that include basic client-participant information such as name, street address, e-mail address, and phone numbers. Demographic data, such as age, sex, and race may also be recorded. The informed consent and all outcome forms should now be given and explained to the client to be filled out for baseline data. The herbalist-researcher, at this point, may also note characteristics of the client-participant that 'paints a picture' of that person, which may serve as objective data observed by the herbalist-researcher, as opposed to the subjective views recorded by the client-participant in their outcome data. For example, if the client-participant being treated for arthritis appears pessimistic, tired, or seems to shuffle entering the office, these detail may be noted by the herbalist researcher. A duel diagnosis should be recorded during this visit, including both the conventional diagnosis (i.e.-rheumatoid arthritis) as well as the practitioner's diagnosis, relevant to their practice philosophy.

5.7.2 Treatment

Documentation of the treatment protocol utilized is critical to facilitating study replication and critique of disseminated findings. The specifics such as visit frequency, dosage, and reassessments with treatment adjustments, should also be documented.

For the most accurate statistical analysis, the duration of treatment should be predetermined for each individual study. The length of treatment will be determined by

the skill of the herbalist-researcher and their experience with the condition or herb being studied. For example, this author might chose to study the effects of *Oxalis spp.* on mood for a two-month period, on a particular client, as she is familiar with its effects and the length of time the herb has typically been taken by past clients to restore emotional balance. As a guiding principle, Mills et al (2000) say to expect three months of treatment for every one year of the health condition, with one additional month for each additional year. Again, this will be determined by the herbalist-researcher for his/her own study. An N=1 case study is used to document change in the studied outcome measures. Treatment may or may not be 'complete,' depending on the purpose of the study, but the study should effectively document the change that has been incurred during the time-frame studied.

5.7.3 Post-Treatment

The study will be strengthened by collecting data post-treatment for the longest period possible, which will allow the maximum amount of time for symptoms that would normally reoccur to manifest themselves. The data collection points post-treatment would ideally follow the normal exacerbation of symptoms if they were at extended intervals, such as menstrual headaches. In this case, outcome measurements may be recorded monthly for three months to record consistent change. The herbalist-researcher might again paint an 'after' picture of the client-participant, as objective data, to contrast with the pre-treatment 'picture.' Assessing the client-participant, for example, after a year would be relevant to see if the treatment is lasting.

The length of post-treatment study is determined by each herbalist-researcher depending upon the herbalist's practice philosophy, length of the study itself, condition and/or herb being used. In the prior example of *Oxalis* for mood disorders, this author might ask the client to fill in data points one time a week, post-treatment, for one month. This author might also consider collecting data at a three month follow up, as that also might provide relevant information to the herb's longer term efficacy. This author chooses these time points because she believes, based on her practice philosophy, that one month post-treatment would be sufficient to recognize if the client-participant's 'vital force' had sufficiently been stimulated to restore and hold that person's emotional balance. A three-month time point would confirm the maintenance of the herb's effect. If another herbalist-researcher had provided treatment for six months, that researcher might consider collecting post-treatment data for a longer period of time, depending upon researcher expectations.

The practitioner-researcher should establish a protocol for reminding the post-treatment participant of subsequent data collection time points, and the anticipated final study date (e.g., phone calls, e-mail, postal service) per client preference or per the IRB. At the conclusion of the study, the researcher may collect additional process outcome data such as qualitative feedback regarding the study process, and/or client experience (these would have been included in the ethics review and informed consent process), in addition to the study outcome data. The process data will ideally be collected by someone other than the researcher according to the approved IRB protocol.

In chronic conditions, after the study is completed, the client-participant may request a continuation of treatment. This should be noted in the final research. The post-treatment data surrounding lasting effect, would be lost, for the study purpose. However, valuable qualitative data could be gathered and reported in the research, by recording the details of the client's decision to continue treatment. The herbalist-researcher might consider providing a one year follow-up to the study, in such a case.

After data has been gathered, the research question can be answered. Data analysis and dissemination ensues.

5.8 Data Analysis

5.8.1 Presenting the Data

Historically the results of quasi-experimental designs in the behavioral sciences were reported using visual charts (Ottenbacher 1986). Charts are limited in the data each chart can present (i.e., one outcome measure per chart). Statistics are better able to handle the complexity of multiple outcome measures (C. Garcia, personal communication, 2008). Statistical computer software programs allow for the ready analysis of data. The use of both techniques would strengthen the analysis of the data and both are often used simultaneously to depict the results of research.

If herbalists perform research for their own community of practitioners and students, charting may be sufficient. That being said, it would enhance the research generally, and strengthen the research for the broader scientific community, if herbalist-researchers were

to conduct research depicting results from multiple angles. Qualitative data analyzed in a meaningful way would provide valuable insight, as would quantified data depicted in graphs and through statistical analysis. Statisticians are valuable resources for quantitative analysis. Qualitative analysis may require mentoring or collaboration with a researcher with prior experience and expertise in this type of research. Contacting other researchers for their expertise may provide connections for possible research collaboration.

5.8.2 Dissemination

Study and data dissemination in peer-reviewed journals are critical to the advancement of the herbalist's profession, both to enhance discussion amongst herbalists as well as inform the greater scientific community concerning work that is done within the herbal community. The written results of research follow a standard format that varies slightly from discipline to discipline and possibly between journals. This author encourages practicing herbalists who are not necessarily well versed in research presentation to pursue publication. Therefore, a standard format for preparing a manuscript in which qualitative and quantitative data are presented, with considerations of model validity, can be found in Table 4.

Table 4. Standard Sections of a Research Paper to Present Quantitative and Qualitative Data

Section	Details of the Section
Preliminary Material	
Abstract and Keywords	In order for databases such as Pub Med, CINHAL or AMED to catalog the study and have a ready recap of the study available to others interested in herbal research, an abstract must be available. This section often has 250-300 words including 'Aims and objectives,' 'Background,' 'Design and methods,' 'Results,' 'Conclusions,' and possibly 'Relevance to clinical practice.'
Introduction	The introduction may include the background and significance of this particular study. It may include results from the literature search, criticism of previously published research and/or how this research improves upon previous research methods. It may include why this research design is a valid model for herbal research, in contrast to previous methodology. A duel diagnosis of both the biomedical diagnosis as well as the holistic herbal diagnosis would benefit the study, strengthening its model validity This section may also include a subsection on the conceptual framework that this particular herbal treatment is based upon.
Methods and Materials	
Design	A complete description of the research design should be included.
Participants and Setting	Inclusion and exclusion criteria, and any recruitment techniques are presented here with the particular demographic characteristics of this particular client-participant. Ethical approval and details of

Section	Details of the Section
Participants and Setting (cont.)	the consent form should be stated. Details of the practitioner/researcher, descriptive data about the client-participant, recorded by the herbalist researcher, may be presented here. Setting details may be included.
Instruments/ Outcome Measures	This section should give detailed information on selected outcome measures utilized and why, as well as analysis technique for measurement.
Procedure/Treatment/Intervention	Because the treatment and symptom severity may vary from appointment to appointment, details may best be displayed in a detailed chart of herbs and dosage, symptom changes, as well as other interventions suggested at each appointment.
Analysis of Outcome Measure Results	This section includes charts displaying the results of outcome measures (improvement or decline of symptoms, etc) as well as statistical analysis and written narrative as translation for those unfamiliar with statistics.
Results	This section presents data findings, including possible explanations for these results.
Limitations/Strengths	This section accounts for confounding factors, including the strengths and limitations of the study.
Discussion	This section is often quite long. It recaps the study, analyzing the results of the data, including alternate explanations, within the context of extant literature. Discussion may include the particular herbs used and why, interpretation of the treatment and client response. Client/participant comments may

Section	Details of the Section
Discussion (cont.)	be included in this section. This section contains suggested areas for future study, including how a similar study may be improved upon.
Conclusion	This section is frequently omitted in research studies. If it is included, it is extremely brief, recapping the reason for this particular study, its findings and suggestions for future studies.
	End Matter
Acknowledgements	Thanks people who may have helped during the study, including manuscript editors and possibly participants.
References	Sources that have informed the study are included.

6. DISCUSSION AND CONCLUSION

6.1 How this Research was Conceived

CAM, including herbal medicine, is widely used in the U.S., yet there is little scientific evidence supporting its efficacy. Consequently, there is caution and hesitancy in medical practice to support CAM use. Most herbalists are minimally involved in scientific research concerning their own medicine. It is likely that herbalists would like to contribute to the development of the knowledge base in their field, yet many practicing herbalists are limited by time, research knowledge, and resources to conduct large-scale studies considered the gold standard of scientific research. Even then, such large scale studies may not be the ideal circumstances to demonstrate holistic herbal practice. This project was undertaken to determine if case studies might provide a clear, understandable and accessible method for herbalists to conduct meaningful research.

6.2 Literature Search and Results

Initially, this author set out to provide a scientifically sound case series model for the everyday herbalist to provide evidence from practice, considering that more cases might provide more evidence. Medical case series models utilized exclusively quantitative data, based on medical testing. This method was determined to be inappropriate due to limited accessibility to the everyday herbal practitioner. Subsequently, qualitative case series models from the social science field were explored due to the extensive depth of knowledge in social sciences regarding the case series. A case series model that employs solely a qualitative method was judged to be labor intensive and to require extensive

research technique and analytic expertise most practicing herbalists do not have. Furthermore, it was determined by this author, from the recommendations of prior researchers (Vickers 2002; French et al 2001) that it would be best to start simply with a single case study, which could be transformed by future researchers, into a case series, by replication. A mixed-method approach to the case study model was determined to be more readily available to a practicing herbalist. The focus of the paper was narrowed in order to provide an accessible single case study protocol, with considerations of internal, external and model validity.

In 2000, the EBM working group advocated the N=1RCT protocol as best evidence for the treatment of individual patients. The N=1 model is considered a quasi-experiment, as it involves measuring quantifiable data, with the single patient acting as his/her own control. A critical review was conducted of the N=1 models adapted from the behavioral science field. The AB model, similar to everyday practice, involves little baseline measurements, aside from current symptoms. Treatment would then be evaluated as to its effects. This is considered a poor experiment and would not provide scientific evidence as to the effectiveness of herbal treatment.

Also critically evaluated was the N=1 RCT (ABAB) adopted by the biomedical community. This model involves administering and withdrawing treatment, by providing a placebo, at random intervals, to study differences in effectiveness between treatment period and placebo period. Logistically and philosophically, this model is not a good research fit within the context of herbal practice in real-life settings. Withdrawing

treatment from paying clients, as well as administering placebo would be ethically and professionally inappropriate. Controlling to isolate symptoms, thereby ignoring the rest of the client, or controlling the remedy, by only focusing on one remedy, while appropriate to a practitioner, such as this author, who practices with 'simples,' would not be appropriate to most herbal practices. Herbal treatment is expected to have a slow, cumulative effect, sometimes inducing initial aggravations that lead to healing (Mills et al 2000). Furthermore, the effects of herbal treatment do not quickly disappear because the herb is withdrawn. The only possible feature that might be usefully extracted from this protocol, for herbalists, was partial blinding by using a third blinded observer to record or receive effectiveness data from the client. Overall, the N=1 RCT was conclusively not a practical model for practicing herbalists.

Advocates of the N=1 trial have suggested that a case series could be produced by simply repeating the N=1 protocol on multiple patients. Searching related literature, this author became aware of the N=1 pre- and post-testing model, utilized in CAM. The N=1 pre- and post-testing model involves strengthening internal validity by establishing a baseline of outcome measures prior to treatment. Individualized treatment is then provided to the patient. Predetermining the length of treatment is considered ideal, as this will assist later statistical calculations. All treatment details and changes are recorded by the herbalist-researcher. Post-treatment measurements are then recorded. Outcome measures are recorded by the client at whatever intervals are determined appropriate to the study, by the herbalist-researcher. Qualitative data, such as open-ended questions embedded in the outcome measures, can be utilized in this method as well. Inherently flexible, this type of

study can allow an herbalist-researcher to study an individual symptom or herb, or the more commonly complex multifaceted illnesses that commonly present in practice, as well as utilizing complex herbal combinations, to display the overall effects of treatment. Chronic, relatively stable conditions, which are commonly seen in herbal practice, are ideal for this type of study.

A prospective approach was suggested because it eliminates issues of bias and allows the practitioner to consistently measure change from start to finish, thereby enhancing internal validity. To enhance model validity, a double classification of diagnosis, including the conventional and herbal diagnosis was recommended by this author. Additional qualitative data, such as practice philosophy or theoretical framework descriptions, by the herbalist-researcher, will serve to provide meaning behind the treatment protocol. To strengthen the usefulness of disseminated study findings, it is recommended that both visual analysis through charts, and statistical analysis, be utilized.

Possible research purposes and questions have been outline to demonstrate clearly how this research could be used in practice. This includes (a) researching common or unusual herbs, (b) studying common or unusual conditions, (c) demonstrating the efficacy of a single herb or general herbal treatment on chronic conditions, or (d) refuting common assumptions in either the herbal or conventional medical community.

A step-by-step approach for how the N=1 pre- and post-testing method might be utilized by practicing herbalists was outlined. This systematic protocol may facilitate conducting

scientifically sound, intrinsically and extrinsically useful, case studies. Issues surrounding selection and use of outcome measures were addressed as part of this protocol development. Considerations for herbalists were identified, such as treating a physical condition, but still measuring effects in other areas of the client's well-being, as that is considered an expected 'side effect' of herbal treatment. Also addressed was how herbalist-researchers identify and provide qualitative information concerning confounding factors that are seen and frequently occur in practice. Ethical research considerations were discussed, as were possible recruitment, screening, and retention techniques for study participants.

An easy-to-follow chart was developed by this author to aid new herbalist-researchers in preparing findings in a standard publication format. Unique considerations particular to CAM research were described, such as dual diagnosis, conceptual framework of the particular herbalist-researcher, a recommendation on how to present details of treatment, including discussion of herbs used and the practitioners practice philosophy, in context of the results.

6.3 What This Study Contributes to Herbal Medicine

This study has contributed to the field of herbal medicine by developing an accessible, scientifically grounded research method protocol a practicing herbalist can utilize. This protocol could facilitate research dissemination that would grow our discipline and contribute to the maturing of our profession. The N=1 pre- and post-test case study protocol provides a clear, accessible means for herbalists to conduct meaningful research.

The case study method promotes education within the herbal medicine community that is empirically grounded. This author has suggested using the N=1 case study to introduce the broader herbal community to common herbs, such as *Oxalis spp.*, not commonly used in mainstream herbalism, or using the N=1 case study to refute common assumptions within mainstream herbalism, such as the lack of efficacy of drop doses. This case study method could also serve to educate the biomedical community by providing foundational data suggesting medicinal use of herbs for future funded studies, as well as serving to inform conventional medical practitioners of the efficacy of individualized herbal treatment, thereby improving the status of professional herbalists.

1.4 Limitations

6.4.1 Limitations of the Pre- and Post-Test N=1 Study

Despite careful record keeping, change or observed effect may be attributed to factors other than treatment. N=1 studies, being limited in size, cannot be generalized to the broader population, nor are they intended to be. Instead, by providing detailed descriptions of practice philosophy and rationale for the use of particular herbs, they may serve as useful descriptions that will provide insights into possible herbal medicine pathways of action. This information could create a foundation of knowledge upon which more advanced inquiry into correlation and causation could occur.

6.4.2 Limitations of This Study

Guidelines for the pre- and post-test model are provided in the format of a protocol. Specific outcome measures, baseline periods, treatment periods, post-treatment periods,

or recommended measurement intervals are not designated because these are driven by the unique research purpose that each herbalist-researcher will determine for their own study. The extent to which qualitative data are collected must also be determined by each herbalist-researcher based on study purpose and research aims. Furthermore, data analysis strategies will be determined by the researcher in consultation with an expert: in the case of quantitative data, this expert will likely be a statistician who can explore appropriate descriptive or correlation analyses and with qualitative data, an expert can assist the practitioner in understanding the best mechanism for capturing the key themes or content in narrative.

Though the goal of a study was to develop rather than pilot a research design protocol, the study would have been strengthened if a pilot study had been conducted. This is recommended as a next step in the development and use of this case study protocol. Plans are underway to design and execute a pilot case study, utilizing resources from the University of Minnesota. This study has provided an impetus for the author to search out researcher colleagues, who can provide support for pilot testing the viability of this method for practicing herbalist research.

This study did not explore the N=1 case series in depth. This author chose to develop a single case study protocol which ultimately must be tested and believed that elaborating upon a single untested study protocol would be premature.

6.4 Conclusion

The N=1 pre- and post-test model, combining both quantitative and qualitative data within the N=1 single-subject design model has been adapted, by the author, to respond to the concerns and realities of the everyday herbalist. Best practices were drawn from N=1 models utilized in the behavioral sciences and biomedical community as well as from complementary medicine researchers who have previously used the N=1 model. An accessible, valuable protocol template has been proposed for the herbalist to implement in practice. This will facilitative the ability of herbalists to conduct herbal research, which may, in turn, contribute evidence for herbal medicine's effectiveness, as well as raising the status of herbalism as a profession.

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