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Applying 'science' in chiropractic clinical practice

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The chiropractic profession is increasingly expressing the sentiment that chiropractic clinical intervention should rest upon a scientific foundation. Before 'scientific research' can become meaningful in chiropractic clinical practice, it is necessary that field practitioners be conversant with research terminology. If chiropractic clinical practice is to achieve credibility as a scientific mode of health care and if the benefits of a 'scientific' practice model are to enhance patient care, then future chiropractic practitioners must be familiar with a currently accredited scientific frame of reference. A survey of final year chiropractic students at Phillip Institute of Technology found that respondents appreciation of the strength of diverse clinical research methodologies and their ranking of criteria for ascertaining a cause-effect association bears some similarity ($RHO = 0.97$ and 0.98 respectively, $p < 0.05$) to that of the 'scientific' clinical community.
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KEY WORDS: chiropractic, scientific practice, research methodology, cause-effect, clinical intervention, information evaluation, manipulation.

Il est de plus en plus reconnu au sein de la profession chiropratique que l'intervention clinique devrait reposer sur une fondation scientifique. Pour une "recherche scientifique" pertinente dans la chiropratique clinique, il faut d'abord que les praticiens sur le terrain soient au courant de la terminologie de la recherche. La chiropratique clinique ne sera crédible en tant que méthode scientifique de soins de santé, et les avantages d'un modèle de pratique "scientifique" ne rehausseront les soins aux malades, qu'à condition que les futurs chiropraticiens soient familiers avec un système de référence scientifique généralement accrédité. Une étude, entreprise parmi les étudiants en dernière année de chiropratique au Philip Institute of Technology, a révélé que leur appréciation de la qualité de diverses méthodologies cliniques et la façon dont ils classaient les critères indiquant une association de cause et d'effet ($RHO = 0,97$ et $0,98$ respectivement, $p < 0,05$) comportaient une certaine similarité avec celles de la communauté clinique "scientifique".
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MOTS CLÉS: chiropratique, pratique scientifique, méthodologie de la recherche, cause et effet, intervention clinique, évaluation de l'information, manipulation.

Introduction

The evolving ethos of contemporary chiropractic is seeking to integrate a scientific approach with traditional chiropractic philosophy and principles. Despite recognizing that interpretation of scientific fact is culturally determined;[1] science is an almost universally accepted authority by which beliefs about the natural world are justified.[2] Furthermore, use of science as the yardstick in clinical care provides the advantage of enhanced prediction and control.[3] It is perhaps this fact which has hastened the emergence of chiropractic from its metaphysical era; the logic of internal consistency is regarded as a poor substitute for the predictability which may follow rational intervention. In any event, attitudes in chiropractic health care are gradually changing. As Sweaney has said, "The dedicated sense of one's personal responsibility toward propagating the chiropractic message with an almost evangelical zeal may have subsided, but in its place dissatisfaction with unscientific or incomplete explanation of the effectiveness of chiropractic, coupled with less emotive confidence that comes with soundly-based knowledge, projects a more credible profession".[4]

Philosophical concepts which have guided the practice of chiropractic according to Keating and Mootz have been "the conservative ethic (do no harm), self-healing (innate intelligence), the strategic role of the nervous system (subluxation/adjustment), prevention and holism . . . Unfortunately, the science of chiropractic has not enjoyed the same philosophical impetus and direction as has the art".[5] The need for such advancement is now recognized. In academic chiropractic circles, a willingness is emerging to set aside outdated procedures and philosophies and incorporate scientifically valid chiropractic theories.

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Acquisition of the ability to ascertain whether an intervention is likely to be effective and safe provides a good starting point for establishing chiropractic upon a scientific foundation which will ensure clinical benefits commensurate with 'scientific' practice. The best technique for establishing scientific 'proof' is the experimental process. The closest approximation to the natural science experiment which can be achieved in clinical research is, however, the randomized controlled clinical trial. The randomized clinical trial is accepted as the most reliable method for determining the relative merits of different therapies;[6] in fact, unless the main sources of bias can be recognized and avoided there is no satisfactory alternative.[7–9]

In situations in which information derived from randomized controlled clinical trials is unavailable, data derived from epidemiological studies may nonetheless prove helpful. The potential clinical validity of conclusions which may be derived from epidemiological studies differs according to study design. Prospective longitudinal or cohort studies, like controlled clinical trials, can serve as data upon which relative risk may be computed. Although useful for determination of an odds ratio, case-control studies cannot serve as the data base for computation of relative risk. Case reports lack sufficient data upon which to base rational cause-effect inferences; they may nonetheless serve as an indicator of topics worthy of further scrutiny.

The contemporary trend in clinical research towards increased reliance on quantitative epidemiological methods[10] is accompanied by the realization, that epidemiological studies may be fraught with methodological problems.[11,12] Not least of these is the necessity that clinicians be capable of discriminating between statistical significance and clinical importance. Biologically useful outcomes may not be statistically significant; the converse is also true. Although epidemiological surveys can identify statistically significant correlations in population groups, population correlations may have no biological importance for individuals. Conclusions are based on probabilities and on traditional, but arbitrary, definitions of the power of chance; on time trends in aggregates of data, rather than on trends in the individual.

It is in this analytical environment that the subjective improvement witnessed by thousands of chiropractors and experienced by millions of patients is being questioned. Better substantiation of the efficiency of chiropractic care than that apparently provided by uncontrolled clinical experience and anecdotal accounts is being sought.[13] Evaluation of chiropractic within an accepted scientific methodological framework is being advocated.[14] Implementation of a scientific approach to daily practice has been proposed as a means whereby the gap between 'science' and clinical practice may be bridged and the profession's research goal facilitated.[15,16] Participation by field chiropractors is envisaged as an integral part of this profession's research enrichment.[17]

Before any expectations that field practitioners will evolve as competent contributors to the scientific practice base of chiropractic health care can be realized, it is imperative that they are capable of evaluating currently available therapeutic information according to a recognized 'scientific' framework. If this perspective of chiropractic clinical practice is to grow and persist, then it is also necessary that graduating chiropractic students have, at the very least, an appreciation of the quality of information derived from various research models. Before the utility of various interventions can be adequately ascertained some appreciation of the relationship between efficacy, safety and the criteria for establishing a cause-effect relationship are also essential. This paper examines the cognitive appreciation final year chiropractic students appear to have of the potential clinical usefulness of information in the context of its 'scientific generation'.

Methods and materials

A group of fifth year chiropractic students at the Phillip Institute of Technology were circulated with a questionnaire which invited them to rank various research formats and diverse associations according to their potential usefulness in scientific clinical decision making. All students presenting to a non-compulsory class were presented with the questionnaire and invited to participate in the survey. Participation was optional and 35 of the 36 students present chose to participate. In view of ethical implications associated with the distribution of questionnaires to students, it was considered unwise to request an explanation from the student who chose not to participate lest this be construed as harassment. Students participating in the survey had completed a unit in research methodology and statistics during their fourth year of study. They had also completed a nutrition unit during which the clinical implications of information derived from various sources had been discussed.

Respondents were requested to rank a number of variables according to their perceived importance in influencing management decisions when using nutritional supplements. They were also requested to indicate which research design they regarded as the most powerful for determining the efficacy and safety of nutritional supplements. Cumulative scored rankings were calculated using an index which weighted each response and provided a means of comparing the perceived relative importance of each variable. The index is derived by multiplying the number of responses selected for each ranking by a weighted variable and adding the total weighted reponses for a given item. The sum of the weighted responses for a given item is then divided by the number of participating respondents. The weighting of rankings is a function of the total number of options present. In a nine option ranking, the first option carries a weighting of nine, the third a weighting of seven. This weighting method provides a mechanism whereby the responses of each individual are pooled, enabling the group's overall reponse to each option to be acccurately ranked.

Using a fixed response format, respondents were invited to omment on the evidence which they considered most likely to correctly substantiate a cause-effect relationship between a supplemented nutrient and a favourable clinical outcome. The

underlying assumption is that substantiation of a cause-effect relationship provides a mechanism whereby intervention efficacy can be judged.

Results

When requested to indicate which information sources they regarded as most likely to provide them with information about the safe clinical use of nutrients, respondents listed in order of decreasing probability: longitudinal epidemiological studies, cross-sectional epidemiological studies, clinical trials, physiological logic, case studies and, the source with least guarantee of future safe use, previous personal experience. (See Table I) Further data analysis gives a Spearman Rank coefficient (RHO) of 0.97, $p < 0.05$. It should be noted, that the variable 'a clinical trial' in the original questionnaire failed to adequately distinguish between a randomized controlled trial and an ad hoc group of case studies (case series).

Table II summarizes the respondents rating of diverse methods for determining clinical efficacy. It shows the proportion of respondents selecting each listed item and compares their perceptions to the rating used by Sackett et al. for ascertaining causality.[11] Further analysis of the data was undertaken by ranking the results detailed in the four-plus category (++++). Comparison of this ranking with Sackett et al.'s list results in a RHO = 0.99, $p < 0.05$. Compared to Sacket et al., respondents overvalued the importance of a strong cause-effect association based on findings derived from case-control studies. Similar overestimations are found with regard to the scientific validity

TABLE I
RANKING OF METHODS FOR DETERMINING THE SAFETY OF NUTRITIONAL SUPPLEMENTS (N = 35)

	Methodological Listing According to Sackett et al.[11]	Respondent Ranking (Cumulative Weighted Index)
STRONGEST ↓	Randomized clinical trial	4.49*
	Longitudinal/ cohort study	5.26
	Cross-sectional/case control study	4.89
	Case series	2.4
Weakest		
Unlisted	Physiological logic	3.06
	Previous personal experience	1.4

* Questionnaire stated 'Clinical Trial' and did not specify control or randomization.

TABLE II
RESPONDENTS EVALUATION OF THE IMPORTANCE OF DIVERSE METHODS FOR DETERMINING THE EFFICACY OF NUTRITIONAL SUPPLEMENTS IN CLINICAL PRACTICE (N = 35)

Evaluation method of cause – Clinical outcome relationship	Sacket et al.'s rating of the effect of a positive result on a causal decision[11]	Respondents rating of the effect of a positive result on a causal decision			
		++++	+++	++	+
Randomized clinical trials	++++	41%	35%	24%	0%
Consistent association	+++	24%	38%	35%	3%
Strong association on cohort study	+++	9%	65%	21%	5%
Dose-response gradient	++	15%	44%	30%	11%
Epidemiological sense	++	9%	38%	41%	12%
Appropriate temporal relationship	++	6%	21%	44%	29%
Strong association on case-control study	+	9%	65%	21%	5%
Biological plausibility	+	6%	38%	41%	15%
Analogy	+	6%	29%-	47%	18%

of biological plausibility and analogy. The significance of randomized controlled clinical trials and an appropriate temporal relationship tended to be somewhat underestimated.

On applying the weighted index analysis to this data, participants were found to have ranked the listed options, in decreasing order of importance, as: evidence from randomized controlled clinical trials, a consistent relationship, a strong association on case-control studies, a dose-response curve, a strong association on cohort studies, an epidemiologically plausible association, a biologically plausible relationship, an analogous association, with an appropriate temporal relationship being considered least helpful. One of the respondents misread this section and provided an incomplete ranking rather than the requested rating; this response was omitted from the analysis.

Participants were also requested to rank nine listed variables according to their potential importance in clinical management decision making when using nutritional supplements. Ranked in order of decreasing importance, respondents considered the following information most useful when prescribing nutritional supplements in clinical practice: safety, contraindications, indications, effectiveness, interactions with drugs, dose, mechanism of action, interaction with nutrients and, least important, financial cost (see Table III).

Discussion

Respondents appear to recognize that practice considerations based upon physiological logic, case series and previous personal experience are a poor substitute for interventions substantiated by randomized controlled clinical trials, cohort, case-control and even cross sectional studies. Physiological logic, although internally consistent, does not inevitably have any rational basis. Case series, a valuable early guide to potentially fruitful research directions, are a collection of objectively monitored anecdotes. Personal previous experience may provide a 'comfortable' cognitive framework but fails to meet the basic criteria of acceptable 'scientific' clinical practice. By designating these options as relatively weak methods for determining the safety of nutritional supplements in clinical practice, chiropractic students demonstrate the discernment expected of conventional health care practitioners. Table I shows that chiropractic students' appreciation of the strength of information derived from various research frameworks is somewhat congruent with that of 'scientific' medicine. Further refinement in epidemiological thinking is, however, desirable.

TABLE III
RESPONDENTS RANKING OF VARIABLES PERCEIVED TO BE IMPORTANT IN THERAPEUTIC DECISION MAKING WHEN USING NUTRITIONAL SUPPLEMENTS
(N = 35)

Variables ranked in order of decreasing importance	Cumulative weighted index derived from respondents answers
Safety	7.26
Contraindications	7.08
Implications for use	6.80
Effectiveness	5.78
Drug-interactions	5.14
Nutrient dose	5.00
Mechanism of action	4.54
Nutrient interaction	3.97
Financial cost	1.74

Dominant within any research format is the desire to demonstrate a cause-effect relationship. Associations which are most likely to be causally linked are best assessed using randomized controlled clinical trials, or failing that, prospective cohort studies. Case control studies provide evidence of an association; but an alternate approach is required to establish a causal link. As ideal experimental and epidemiological studies are not always feasible, a number of criteria which favour the possibility of a causal relationship have been identified. The probability of a cause-effect association is enhanced where there is:[18]

1 substantiating evidence from 'experiments' in humans;
2 consistency between different studies supporting the postulated outcome, i.e. a repetitive demonstration of a relationship between the intervention and outcome is noted;
3 the intervention preceeds the outcome, constituting an appropriate temporal relationship;
4 a dose-response relationship; and
5 a strong association between the intervention and the response.

Strength is the relative odds of an outcome in persons given a particular intervention compared to those who received no intervention. Additional support for a cause-effect relationship is derived from an association which makes epidemiological and/or biological sense and is analogue to a previously proven causal association. A specific association is favourable but not obligatory.

Although there is good correlation between respondents four-plus listings and Sackett et al.'s prioritization of cause-effect criteria, Table II shows that the respondents place relatively undue emphasis upon case-controlled studies, biological plausibility and analogy. While case-studies are more readily clinically accessible to field practitioners, their availability should not be confused with their potential usefulness as a source of clinical information. Incorporating an appreciation of the relative strength of various research methodologies into a routine practice framework, as well as a critical evaluation of reported associations according to cause-effect criteria, will enable indi-

vidual chiropractors to ascertain whether any proposed intervention is efficacious, safe, and/or preferable to another.

The potential usefulness of science in clinical practice is realized when the utility of an intervention can be objectively determined. Afterall, "Science differs from common sense knowledge, not in the elimination of preconceptions, but in the precision with which some of these preconceptions are formulated and the detail with which they are used to guide observation".[19] It is, therefore, not surprising that a major constraint on what counts as knowledge in society is that such information be objectively assessed.[20] Objective assessment of chiropractic clinical practice will help to ensure that chiropractic knowledge achieves suitable recognition.

While establishing their scientific credentials, chiropractic practitioners should remain mindful that science and health care are non-identical activities. "Scientific norms concern knowledge and do not deal directly with practical outcomes; risk is not a central concern. In contrast, the goal of practice is healing; it is particular and local in its nature. . . . Practice consists of encounters that require action, sometimes conclusive action; the avoidance of harm is a key norm."[21] In our study, the respondents top ranking of safety and their awareness of contraindications to intervention in therapeutic decision making is congruent with this perspective. In fact, respondents regard knowledge of the indications for, and the efficacy of supplementation, as a secondary consideration following familiarity with information about the safety of and contraindications to, the use of nutrients in clinical intervention. Clinical practice is not merely applied science and the clinician is different to the scientist. These differences are being retained in a group displaying a measure of cognitive scientific awareness.

As the "scientific method uses falsifiability rather than verification as a criterion of demarcation",[22] scientific knowledge will never be complete. As science does not generate truth but merely more reliable knowledge, the search for better understanding is a self-perpetuating process. It is fallacious to assume that existing and traditional practices need not be scientifically proven.[23] Professional knowledge, based on custom and personal experience, should not be regarded as so authoritative as to be protected from having to justify itself by logic.[24] On the other hand, neither should scientific principles acquire a 'theology' to the exclusion of tradition, experience, learning and intuition.[25] Clinical practice using a scientific approach should enhance patient care and not be permitted to detract from or replace the holistic patient-practitioner relationship.

Conclusion

Despite limitations inherent in a 'scientific' approach, the chiropractic profession has deemed it desirable that it secure a 'scientific' practice base. Analysis of final year chiropractic students at the Phillip Institute of Technology suggests, that the basic information upon which the chiropractic profession may build a 'scientifically' sound practice base is being addressed at the undergraduate level.

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