

# A Retrospective Assessment of Network Care Using a Survey of Self-Rated Health, Wellness and Quality of Life.

Robert H. I. Blanks, Ph.D.<sup>1,2</sup>

Tonya L. Schuster, Ph.D.<sup>3</sup> Marnie Dobson, B.A.<sup>1</sup>

**Abstract** — The present study represents a retrospective characterization of Network Care, a health care discipline within the subluxation-based chiropractic model. Data were obtained from 156 Network offices (49% practitioner participation rate) in the United States, Canada, Australia, and Puerto Rico. Sociodemographic characterization of 2818 respondents, representing a 67-71% response rate, revealed a population predominately white, female, well-educated, professional, or white collar workers. A second objective of the study included the development and initial validation of a new health survey instrument. The instrument was specifically designed to assess wellness through patients' self-rating different health domains and overall quality of life at two "time" points: "presently" and retrospectively, recalling their status before initiating care ("before Network"). Statistical evaluation employing Chronbach's alpha and theta coefficients derived from principle components factor analyses, indicated a high level of internal reliability in regard to the survey instrument, as well as stable reliability of the retrospective recall method of self-rated perceptions of change as a function of duration of care. Results indicated that patients reported significant, positive perceived change ( $p < 0.000$ ) in all four domains of health, as well as overall quality of life. Effect sizes for these difference scores were all large ( $>0.9$ ). Wellness was assessed by summing the scores for the four health domains into a *combined wellness scale*, and comparing this combined scale "presently" and "before Network." The difference, or "wellness coefficient" spanning a range of -1 to +1, with zero representing no change, showed positive, progressive increases over the duration of care intervals ranging from 1-3 months to over three years. The evidence of improved health in the four domains (physical state, mental/emotional state, stress evaluation, life enjoyment), overall quality of life from a standardized index, and the "wellness coefficient," suggests that Network Care is associated with significant benefits. These benefits are evident from as early as 1-3 months under care, and appear to show continuing clinical improvements in the duration of care intervals studied, with no indication of a maximum clinical benefit. These findings are being further evaluated through longitudinal studies of current populations under care in combination with investigation of the neurophysiological mechanisms underlying its effects.

*Key Words:* Network spinal analysis, vertebral subluxation, chiropractic, self-rated outcomes assessment, wellness, overall quality of life.

## Introduction

Network Care is a health care discipline within the subluxation-based chiropractic model<sup>1</sup> practiced by members of the Association for Network Chiropractic (ANC), nationally and

internationally. Building from a base of consistent clinical observations, and repeated anecdotal reports of health benefits, the present study was conducted to fulfill the following three objectives: (1) to characterize the patient population undergoing Network Care; (2) to develop a new survey instrument of sufficient design and scope to allow assessment of a non-medical health discipline, and (3) to assess changes in patients' self-rated health, wellness, and overall quality of life.

Network Care is founded on the premise that individuals free of the complex of factors precipitating from, or leading to, vertebral subluxation experience a greater range of inherent adaptability and, hence, a greater sense of relative health or wellness. In a large percentage of individuals, Network Care evokes spontaneous self-perpetuating contractions of the paraspinal musculature.<sup>1</sup> The movements may be subtle, barely perceptible, or very

<sup>1</sup>Department of Anatomy and Neurobiology, <sup>2</sup>Department of Otolaryngology-Head and Neck Surgery, College of Medicine, <sup>3</sup>Department of Sociology, University of California Irvine, Irvine, CA 92697.

*Address reprint requests to:*

Robert H. I. Blanks, Ph.D., Professor, Department of Anatomy and Neurobiology, College of Medicine, University of California, Irvine, California 92697-1275.  
e-mail: rhblanks@uci.edu

obvious and may involve the arms and legs. Over a period of several months, physiological and psychological changes have been observed clinically, including increased flexibility of the spine, increased range of motion, improved mood and sense of relaxation, self-reported “wellness,” and greater capacity to cope with stressful situations. These observations provide a basis for considering that Network Care involves body-mind interactions.

Consistent with the definition of health offered in 1958 by the World Health Organization,<sup>2</sup> as being “a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity,” overall improved health is one of the clinical objectives of Network Care. Until recently, methods to assess health changes relative to this definition have been unavailable.

However, with the advent of new outcome measurements for physical, mental and social well-being, as well as a greater awareness of the need to provide patient-centered outcomes, many disease treatment modalities are beginning to evaluate the effectiveness of their intervention in regard to the more holistic WHO definition of health.<sup>3-4</sup> Ironically, while this adds a greater understanding of “holistic” health to the medical perspective, this approach is not yet widely adopted in the area of health care where it would be most applicable, i.e., non-medical practices that have as their primary clinical goal the enhancement of overall health. This is perhaps due to the disease-specific orientation found in most recently developed surveys.<sup>5</sup>

A more thorough investigation of the efficacy of non-medical approaches is also confounded by a confusion of terms arising from the changing medical perspective. This new lexicon developed to accommodate the increased public and scientific interest and utilization of various practices considered outside of orthodox (allopathic) medicine. Terms such as “complementary” and “alternative” medicine, while useful in categorizing practices which treat disease but are outside of orthodox medicine (e.g., homeopathy, acupuncture), fail to differentiate those practices (non-medical) whose clinical objectives do not involve direct intervention in symptom alleviation or the treatment of disease.

By grouping all health care disciplines considered “outside” orthodox medicine under the umbrella of “complementary/alternative medicine,” and then requiring that acceptance of these modalities be preceded by an evidence base derived from randomized clinical trials substantiating disease-treatment efficacy, the non-medical objective of certain disciplines (e.g., subluxation-based chiropractic) is ignored. For example, a specific practice may not be effective in improving the symptoms of arthritis, although it may be effective in improving other aspects of health such as physical, mental, or social well being. Consequently, dismissal of a given practice based on its lack of medical efficacy, without appropriate attention to its non-medical effects, does little to identify why it is being utilized or how it is important in the evolving holistic concept of health.

An example can be seen within chiropractic, where one school of thought views musculoskeletal manipulation as a means of treating certain diseases and/or dysfunctions.<sup>6</sup> Chiropractic practiced under this objective would qualify as a drugless, but palliative (symptom-based) therapy. Consequently,

it could be argued that its allopathic objective renders it a form of complementary or alternative medicine and thus could be readily assessed using research methodologies commonly employed in medicine. In contrast, another school of thought within chiropractic (to which Network Care aligns) views correction of the condition of vertebral subluxation as a means of enhancing the body’s inherent adaptive abilities, thus improving overall health.<sup>6</sup> This objective, identified with chiropractic since its inception<sup>7</sup> and recently re-emphasized by the Association of Chiropractic Colleges,<sup>8</sup> differentiates it from the clinical objectives of medicine. Consequently, it seems imperative that more appropriate methods be developed to assess the outcomes of such non-medical modes of health care.

Studies now suggest that global self-ratings of health, as well as being highly predictive of such fundamental outcomes as mortality or longevity,<sup>9-10</sup> are also an effective and justifiable means of measuring broader health outcomes (i.e., not just the presence or absence of disease or symptoms).<sup>4</sup> However, the psychometric survey instruments currently available were developed predominantly to assess general health and quality of life relative to medical interventions,<sup>5</sup> and were found lacking for the purposes of the present study. For example, among the 21 most relevant instruments reviewed and evaluated by McDowell and Newell,<sup>5</sup> none are appropriate to measure changes in a population of patients likely to be presenting for care already in relatively good health (an assumption based on numerous informal interviews with Network Care patients and practitioners). This was an important consideration in the present study as problems exist with “ceiling” effects in many of the instruments reviewed which limit the ability to measure improvement in an already healthy population. Additionally, their lack of breadth or excessive detail,<sup>5</sup> led to the development of a new instrument that would more directly reflect the WHO domains of physical, mental, and social well-being, without being cumbersome.

As with any new survey instrument, the first step involved tailoring the design of the items and scales for the particular condition (wellness) being tested, and beginning the validation process by examining the ability of the instrument to detect change (i.e., responsiveness) in a particular setting.<sup>11</sup> The subscales of the wellness questionnaire items were formulated to reflect aspects of the broad WHO definition of health; including the domains of physical and mental/emotional state, and intra/inter-personal life enjoyment indicative of physical, mental and social psychological well-being. In addition, the wellness domain termed “stress evaluation” (ability to cope with the demands of the environment), reflected aspects of functional ability incorporated into broader contemporary definitions of health. These domains, as well as the combined wellness scale, were compared to a standardized overall quality of life instrument<sup>12</sup> to assist in the process of validating the new instrument.

Typically, changes in outcome parameters are assessed with an “over-time” study design to meet a requirement for establishing causality (the cause must precede the outcome in time). However, longitudinal data (multiple measurements for the same individual over time) is costly and time-consuming, and the design is predicated on knowledge of the relevant time-frame. Cross-sectional studies of large populations are the appropriate first stage, and provide the opportunity to examine other ran-

domly distributed factors which may influence the outcomes. Without longitudinal data, suggestive evidence of change (and causality) must rely on the retrospective recall of respondents. The use of measurements of this form is limited, since merely asking respondents for current health ratings is ambiguous regarding the necessary cognitive frame of reference (e.g., compared to who/when). Moreover, merely asking for degree of change or improvement in health does not provide information on current levels of wellness (or the levels most common among individuals entering Network Care). Thus, the method of asking respondents to rate their level of health and wellness both "before Network" and "presently" was developed, with the difference between these two scores representing "perceived change." This method provided a richer and more explicitly circumscribed format of response, allowing the respondents to clearly recognize an attempt was being made to elicit their perceived degree of change in wellness.

The new instrument was considered, overall, as a "wellness survey," yielding a "wellness coefficient" (reflecting perceived change) derived from the retrospective assessment of the *combined wellness scale*. The instrument was also designed to derive sufficient data to indicate the extent of its internal and external validity for continued use in evaluating Network Care, as well as for potential use in assessing medical and other non-medical health care approaches.

## Materials and Methods

### *Practitioner population*

Network Care is currently practiced by licensed chiropractors recognized through their membership in the Association for Network Chiropractic (ANC), an international organization. In this first stage of sampling, the membership of the ANC was designated as the pool through which the patients were surveyed. All offices were solicited regardless of size, and regardless of full- or part-time practice. Because of the number of ANC practitioners, the census was conducted in two parts. The first survey-questionnaires were distributed in November, 1994 to 145 ANC practitioners with a request to have them completed by their patients and returned by December 30, 1994. The second survey distributed identical questionnaires to the remaining 185 ANC practitioners in March, 1995 with a return request of April 30, 1995. A telephone "tree" was established following each mailing to contact offices at least once, to encourage participation, answer questions, and determine reasons for non-participation.

From the 330 registered practitioners in the United States, Canada, Puerto Rico, and Australia, telephone follow-up revealed 9 were not practicing, leaving a total of 321 eligible to participate. From these, responses were obtained from 156 offices, yielding a practitioner participation rate of 49%.

### *Patient population*

In the patient sampling stage, respondents were solicited through these 156 practices according to the following inclusion criteria: 1) under care for 1 month or more as of the survey date, and 2) 18 years of age or older. University of California, Irvine institutional human subject approval was obtained for the study

which required respondents to provide verbal consent to participate in the study. Practitioners were also instructed to sample accordingly: "all practice members [patients] under Network Care for longer than one month [as of the survey date] are to be included in this study. If there are more than one hundred (100) practice members in your practice, and it is impossible to include them all, then simply include all those who are in the practice on a particular day or days (if possible, include at least 80 members)." The practitioners returned the completed questionnaires which were entered into a database for analysis.

### *Response rate*

Survey research literature indicates that studies of national scope designed for multiple subgroup comparisons (e.g., by gender, age, duration of care, etc.) typically require sample sizes of 1500-2500.<sup>13</sup> A total of 2,818 completed questionnaires were received from these 156 practitioners. In a community study of this size it is difficult to obtain an accurate rate of return because there is no central registry of patients undergoing care. Thus, one purpose of this study was a first attempt to estimate the size of this population. This was done as follows: *First*, the average size of Network practices was estimated with data from 77 participating ANC doctors completing a question on a "Doctor's Survey" regarding total number of patients in their practice. This information was supplemented with an additional survey of 59 ANC practitioners attending a regional ANC training session. Both of these samples reported a median practice size of 40. Within the 156 participating offices, the total number of patients under care was thus estimated to be 6,240. *Next*, this total was corrected to estimate the sub-sample meeting the inclusion criteria by age and duration of care. This was accomplished with data from a sub-sample of thirty randomly selected offices, which provided sociodemographic information about total patient population. An estimated 5-7% of patients were ineligible because they were younger than 18 years, thus excluding 312-427 patients from the total patient population. Data on duration of care across all patients indicated that 15-17% of the total population was ineligible because they were under care less than one month at the time of the survey, excluding 936-1061 patients. *Finally*, the size of the eligible population was adjusted for sampling techniques employed by the larger practices. Since an estimated 12.4% of offices included more than one hundred practice members, the selection process excluded a projected 771 otherwise eligible patients from the pool. Within these parameters, the estimated range of the eligible population of patients from the 156 participating offices is 3972-4221, corresponding to an estimated response rate of 67-71%.

### *Procedures and measures*

In this cross-sectional study, participants completed a one-time self-report questionnaire, consisting of a total of 87 questions (some containing sub-questions). The first objective, to characterize the patient population, was addressed through thirty-two questions eliciting information concerning: 1) patient sociodemographic characteristics [13 questions], 2) general health and health care history [8 new questions], 3) chiropractic care history [6 new questions], and 4) physical responses to Network Care [5 new questions]. The second objective of this

study was the development and evaluation of an appropriate outcome instrument. Therefore, patients were also asked to complete 55 questions, listed in the *Appendix*, concerning self-perceptions of general health, wellness, and quality of life. These questions were developed with reference to previously used measures, and in consultation with a psychometrician. They were designed to elicit self-reported changes in health, wellness, and quality of life using perceptions of scores “presently” against the explicit comparison of retrospectively recalled perceptions “before Network.”

Serving as a point of comparison, 14 of the 55 items were taken from a psychometrically grounded “overall quality of life” instrument used by Woodruff and Conway (1992),<sup>12</sup> and adapted from the original landmark studies of Andrews and Withey (1976),<sup>14</sup> and Caplan et al. (1984).<sup>15</sup> In this instrument, to assess quality of life in a wide variety of areas, item responses were presented in a 7-point scale in Likert format<sup>16</sup> with choices scaled from 1-7 as “terrible,” “unhappy,” “mostly dissatisfied,” “mixed,” “mostly satisfied,” “pleased,” and “delighted.”

A battery of 41 original items were partly adapted from a standard instrument assessing psychological status, “Structured Clinical Interview for DSM-III-R-Non-patient Edition.”<sup>17</sup> Among these was one set of 10 items for evaluating stress (perceived ability to cope with the demands of the environment) relative to several spheres (e.g., family, work, etc.), using a 5-point Likert scale with choices ranging from 1-5 as “none,” “slight,” “moderate,” “pronounced,” and “extensive.” An additional set of 11 original items assessed what was labeled “life enjoyment,” wherein respondents were asked to rate their feelings and experiences contributing to a broad sense of inter- and intra-personal enjoyment on a degree scale of 1-5. Choices included “not at all,” “slight,” “moderate,” “considerable,” and “extensive.” Finally, using a frequency scale of 1-5 representing “never,” “rarely,” “occasionally,” “regularly,” and “constantly,” respondents were asked to rate their physical state (symptoms) and mental/emotional state (feelings, satisfaction) with a set of 10 items each.

Scale items were reverse coded, as necessary, to consistently reflect a higher score as indicative of better health. The items within each of the four domains were used to construct the indices assessing self-rated health.<sup>16</sup> In order to facilitate comparison across scales varying in number of items and response codes, each was re-scaled so that the theoretically lowest scores (i.e., those in which a respondent gave the lowest possible response to all items) were coded 0 and the theoretically highest scores were coded 1.<sup>a</sup> If a given individual answered at least half of the items within a scale, a missing (non-response) value was replaced with their mean response score for the questions they answered.<sup>18</sup> Finally, a *combined wellness scale* was constructed by summing the four wellness domains of physical state, mental/emotional state, stress evaluation, and life enjoyment, and then re-scaling in the 0-1 metric range. Respondents with missing values ( $n = 222$ ) on any of these four scales were excluded from further analyses.<sup>b</sup>

#### *Statistical analyses*

The first concern, dealing with the development and initial validation of wellness-specific outcome measures, was to deter-

mine how well the item indicators (specific questions) and summated health domains indices, represented the theoretical concepts they purported to measure. That is, to what extent did the items/scales serve as valid measures of self-rated wellness and quality of life. Because reliable measurement is a necessary condition in building a case for validity, the first step involved analyses of reliability (essentially repeatability), or the extent to which the measures consistently yield the same results on repeated trials, free of “random error” or chance fluctuations. The more direct test-retest approach not only requires multiple measurements on the same individuals over time, and the often untenable assumption that the trait itself is stable, but is also entangled with any true differences in health associated with treatment (e.g. Network Care). Thus, the more commonly accepted analysis of internal-consistency reliability<sup>19</sup> was used as an indicator of how well the individual items (questions) within a scale reflected a *common* underlying health domains construct. This analysis is based on the logic that confidence can be increased, that the underlying theme of health/wellness is reliably measured by using multiple measuring instruments (questions), and gauging the extent to which the item scores are interrelated beyond random fluctuation. Chronbach’s coefficient alpha is the most often used statistic,<sup>19</sup> and the most conservative test, because it is based on the assumption that all questions contribute equally to the measurement of the single wellness theme. This stringent requirement of “parallel measurement” means that alpha is a lower bound for the reliability of a multi-item scale.

A closer estimate of true reliability is coefficient theta, which relaxes the assumption of parallel measurement. This is considered a maximized alpha coefficient. Also, within the construct of internal-consistency reliability, theta is calculated from the results of principle components factor analyses, which are methods for discovering clusters of interrelated variables. The analysis essentially evaluates the extent to which the items share variability in concert with one another; this “shared variance” represents the underlying construct which, in this case, is the wellness theme of the measures.<sup>20</sup> The primary portion (principle component) of the shared variance among the items (eigenvalue) is a summary of how well the scores on given items account for, or predict, the scores on all other items (factor loadings). Calculation of the reliability coefficient theta is based on the magnitude of this principle component. Both alpha and theta coefficients are a product of the number of items and the strength of their intercorrelations, ranging from 0-1.00, with a cut-off of greater than 0.7 as the widely accepted rule of thumb for demonstrating internal consistency.<sup>21</sup>

In addition to its use in the reliability analysis, factor analysis is also a useful tool for assessing the validity of empirical measures.<sup>20</sup> The pattern of residual co-variation among the variables and factors, after accounting for the common variability in the principle component, was inspected to investigate how well the individual items support the theoretical theme (i.e., wellness domains). In addition, the convergence of the health domain scales and the psychometrically validated overall quality of life index was considered (i.e., reliability, inter-scale correlations, and associations with other available data such as spinal injury, etc).

Using these newly developed health domain scales, the third

objective of this study was the evaluation of retrospectively perceived changes in health and quality of life for patients while under Network Care. This was accomplished with bivariate comparisons of self-rated health scores “before Network” and “presently.” The statistical significance of this difference was determined using two-tailed, paired sample t-tests, which tests the null hypothesis that any differences between individuals’ paired “before Network” and “presently” scores result from chance fluctuation. Insofar as this evaluation involved the use of multiple scales, the usual alpha level of 0.05 was divided by the number of scales (5) to correct for multiple comparisons, yielding  $p=0.01$  at a 99% confidence interval.<sup>22</sup> When the “p” value of this probability did not exceed the 0.01 cut-off, the null hypothesis was rejected, indicating that the difference is statistically significant. That is, at this level, only 1% of the time would the results be due to chance alone, or 99% of the time would the same pattern be found in the population from which the sample was drawn.<sup>c</sup>

In addition, difference scores were calculated within each of the four health domain indices between “presently,” and “before Network,” to determine a patient’s perceived change. Summation of all health domain index scores represented a *combined wellness scale* for both “presently” and “before Network.” The difference score of the *combined wellness scales*, herein referred to as the “*wellness coefficient*,” ranged from -1 to +1, with zero representing “no change,” positive values indicating improved health, and negative values a worsening.

While the large size of this sample assures that a statistically significant effect will not be missed (due to sample error introduced by small sample size), statistical significance alone does not provide insight into the strength of a bivariate relationship or effect. Thus, measures of clinical significance, or size of “treatment” effect, are commonly reported.<sup>24,25</sup> In this regard, effect size was used to measure the magnitude of clinical or meaningful change in the present study. Effect size represents a standardized “benchmark” measuring the magnitude of clinical change.<sup>26</sup> Cohen (1977) provided the widely accepted definition of an effect size of 0.20 as small, 0.50 as moderate, and 0.80 or greater as large, with large being a change of magnitude at least four-fifths of a standard deviation of the baseline measure.<sup>27</sup> The most commonly accepted formula was used for calculating effect size:  $(M_2 - M_1)/S_1$ , where  $M_1$  and  $M_2$  are the group means at time one (“before Network”) and two (“presently”), and  $S_1$  is the standard deviation at time one.<sup>24</sup> This statistic compares the average differences in individuals’ scores “presently” to the amount of deviation across the scores of all respondents “before” beginning care, with the idea that meaningful variations should be valued against the normal range of the majority of individuals’ initial scores.

To better visualize the extent and meaning of clinical effects (effect size) in the sample, the percentages of patients whose perception of health/wellness worsened or improved more than 0.5 standard deviation, or remained stable, were calculated. The specific cutoff values for improvement thus vary as a function of the distribution and variability of each index, and generally reflects a conservative moderate effect size. These cut-offs were superimposed on histograms of the difference scores (perceived change) for each index.

Finally, to investigate if the interval between “before Network” and “presently” varied across respondents according to the duration of Network Care, the characteristics and associations of this parameter were examined. To capture meaningful time-bound differences in wellness, this continuous variable was categorically re-scaled to 1-3 months, 3-12 months, 12-36 months, and greater than 36 months. The categorization was based on the assumption that the influence of the length of time since beginning care does not operate in a linear (one-to-one) fashion with regard to either retrospective recall or the potential wellness related influence of care. Focusing on the validation of the retrospective recall approach, these four duration groups were compared in terms of the internal-consistency reliability of the self-rated health and quality of life indices, as well as other potentially relevant health characteristics. The connection between duration of care and the magnitude of retrospectively perceived changes in self-rated health and quality of life (score for “presently” minus the score for “before Network”) was then examined using analysis of variance (ANOVA).<sup>28</sup> This statistic compares variation across the group means (defined by length of time under care) to the average variation within those groups; the resulting probability indicates the extent to which differences across groups are real or due to chance. In addition, measures of the clinically meaningful variation in wellness, i.e., effect size, are particularly well suited for comparing differences across these treatment duration groups.

## Results

### *Patient Sociodemographic and Health Care Characteristics*

The sociodemographic characteristics of the study population are presented in Table 1. The average age of respondents was  $43 \pm 12$  years (mean  $\pm$  SD) with a range of 18 to 95 years (U.S. mean age = 35 years). There was an over-representation of female (73%) compared to male (27%) respondents, and white ethnicity (94%), with the population reflecting only 1% black and less than 5% representation of all other ethnic groups. Socioeconomic characteristics of these respondents tended to be skewed toward higher education levels (79.6% college or graduate school), professional/white collar (69.8%) occupations, and higher income (Table 1).

A summary of the health histories for the population is given in Table 2. The majority of respondents self-reported their current physical and emotional health as good (64%-68%) or excellent (23%-28%), and only a few rated their physical/emotional health as poor (4%). Not surprisingly, in view of the wellness perspective of Network Care, the population had a low utilization of orthodox medical services, even though there was a relatively high incidence of persistent ailments (58%) and prior injury to the spine (47%). In this regard, only 28% of respondents reported seeing a physician for other than routine physicals; the last visit to a physician averaged  $15 \pm 30$  months previous to completing the questionnaire. Fewer than half of the respondents (38-41%) reported taking any prescription or non-prescription medications currently, or for a duration of at least 2 months at any time in the past.

Patients had been under regular Network Care for an average of  $21 \pm 27$  months (Table 2). The frequency of Network

Care was consistent across offices ranging from an average of 2.7  $\pm$  1.3 times/ week during the first 2-3 months, to 2.4  $\pm$  1.3 times/ week 3-6 months after initiating care, and further reducing to an average of 2.1  $\pm$  1.2 times/ week after 6 months of care. Also consistent across offices, the vast majority of patients (75%) had been under previous chiropractic care for an average of eight years (96  $\pm$  112 months) prior to beginning Network Care. In regard to Network Care, 95% of respondents reported that their expectations had been met, and 99% reported that they would continue care.

Table 1. Sociodemographic Characteristics of Patients undergoing Network Care

Number of respondents:	2,818
Age (years):	43.4 $\pm$ 11.5 (2770)
Gender:	(2799)
Male	26.6%
Female	73.4%
Ethnicity:	(2750)
White	94.1%
Black	1.2%
Asian	1.2%
Hispanic	1.7%
American Indian	0.4%
Other	1.4%
Marital status:	(2551)
Single	31.1%
Married	46.5%
Divorced/Widowed	22.3%
Number of children:	(2615)
None	46.3%
One	15.6%
Two	21.3%
Three or more	16.8%
Occupation:	(2689)
Blue collar	7.5%
White collar	22.2%
Professional/technical	47.6%
Student	6.5%
Homemaker	5.9%
Retired	5.7%
Unemployed	1.6%
Self-employed	3.0%
Education :	(2785)
High school	12.3%
Other (avocational)	8.1%
College	50.3%
Graduate school	29.3%
Income: (median = \$25-34,999)	(2542)
< \$24,999	40.0%
\$25-34,999	18.9%
\$35-44,999	13.5%
\$45-59,999	12.6%
> \$60,000	14.9%

Table 2. Self-reported health history of patients undergoing Network Care.

## I. MEDICAL

1. Current physical state:	(2794)
excellent	25.0%
good	71.0%
poor	4.0%
2. Current emotional/mental state:	(2786)
excellent	29.0%
good	66.0%
poor	5.0%
3. Persistent ailments:	(2684)
	58.0%
4. Physician visits (other than routine):	(2787)
	28.0%
5. Last medical visit (months):	(2324)
	15.0 $\pm$ 29.6
6. Currently taking medications:	(2214)
	41.0%
7. Medications taken for at least 2 months in past:	(1916)
	38.0%

## II. CHIROPRACTIC

1. Spinal injury:	(2737)
	48.0%
2. Time since spinal injury (yr.):	(1075)
	15.5 $\pm$ 17.4
3. Duration of Network Care (mo.):	(2510)
	21.4 $\pm$ 27.0
4. Prior chiropractic care:	(2774)
	75.0%
5. Duration of prior care (mo.):	(1506)
	93.2 $\pm$ 111.6
6. Frequency of Network Care:	
(appointments/wk) initial 2-3 mo. (2240)	2.7 $\pm$ 1.2
initial 3-6 mo. (1812)	2.5 $\pm$ 1.4
> 6 mo. (1539)	2.2 $\pm$ 1.1
7. Expectations met with Network Care:	(2367)
	95.0%
8. Number choosing to continue Network Care:	(2770)
	99.0%

### *Self-Rated Health, Wellness and Quality of Life Scale Item Analyses*

In this study, the efficacy of Network Care was assessed in terms of several newly developed self-rated health indices, as well as the overall quality of life index, which were rated by the respondents both "presently" and retrospectively recalled "before Network." The means and standard deviations for the four domains of health, overall quality of life, and combined wellness scales (indices) "presently," and "before Network" are presented in Table 3. The re-scaled means of the four self-rated health domain scales "presently," ranged from 0.67-0.70, corresponding to a rating of about 70% of the maximum possible in the 0-1 metric. Mean scores "before Network" hovered around the mid-

Table 3. Reliability Coefficients and Means for Self-Rated Health, Wellness and Quality of Life Scales (N ≥ 2596)

INDEX	“Presently”				“Before Network”			
	Mean	St Dev.	Internal Consistency		Mean	St Dev.	Internal Consistency	
			Chronbach's Alpha	Theta			Chronbach's Alpha	Theta
Combined Wellness	.678	.100	.8949	.9110	.507	.138	.9230	.9342
A. Physical State	.701	.121	.7418	.7539	.558	.154	.7581	.7670
B. Mental/Emotional State	.666	.136	.8210	.8310	.494	.190	.8612	.8680
C. Stress Evaluation	.674	.155	.8176	.8336	.483	.199	.8392	.8528
D. Life Enjoyment	.669	.135	.8367	.8490	.502	.145	.8309	.8360
Overall Quality of Life	.700	.142	.9297	.9396	.542	.171	.9447	.9504

point of 0.5, or about 50% of maximum in the same metric, corresponding to perceptions of “moderate/occasionally” in the original response scale. Across the separate scales, respondent variability (standard deviation) was approximately 10% greater “before Network” than “presently,” as would be expected given the cognitive complexity of such recall. The mean for the overall quality of life index is higher on average (with similar variability), but not dramatically different than those of the separate health domains indices for “presently” or “before Network,” or the *combined wellness scale* (summation of all health indices).

The results of the scale item reliability analyses are also presented in Table 3. For all indices, both “before Network” and “presently,” Chronbach’s alpha coefficients are clearly above acceptable levels (i.e., > 0.7), indicating strong internal consistency, that is, an interpretable underlying theme for the scale items of each wellness domain and overall quality of life. Only for the stress evaluation scale did further inspection result in the deletion of an item (stress associated with school) to optimize reliability. For the remaining 54 items, the deletion of any variable resulted in lower reliability for the respective scale, indicating that each provided uniquely important information. Moreover, given that the alpha for the *combined wellness scale* was substantially higher than the coefficients for the separate domains, it is apparent that this overall collection of questions meaningfully reflects a single theme labeled “wellness.” The alpha coefficient for the *combined wellness scale* (as well as those for the separate health domains) compares favorably to the expected higher alpha for the established overall quality of life index.

To further explore the reliability and validity of these scales, principle components factor analyses of the respective items was conducted. Based on resulting calculations (derived from the first eigenvalue [Methods]), in all cases coefficient theta indicated that the items in all scales were roughly parallel (equal) and that factor weighted scaling was not necessary as it would not produce substantially more reliable scales. The set of items in each scale met the established criteria supporting the measurement of a single underlying phenomenon. The first component theme accounts for a large proportion of the variability in the items (as indicated by the magnitude of theta) with gradual decreases across subsequent components. In addition, all items had factor loadings (item contributions to the overall theme

measured by the scale) of greater than 0.4 (exceeding a 0.3 cut-off) on the first component. Moreover, factor loadings of the items indicating their contribution to subsequent components, were less than the contributions to the primary (principal) factor.<sup>19</sup>

To address the relationships between the scales, inter-scale Pearson correlation coefficients both “before Network” and “presently” were examined. Coefficients for the separate wellness domains of physical state, mental/emotional state, stress evaluation, and life enjoyment revealed moderate to substantial correlations, ranging from 0.15 (between physical and enjoyment “before Network”) to 0.67 (between stress and emotional state “presently”). All scales showed slightly weaker inter-scale correlation in the “presently” than the “before Network” scores. Overall, the magnitude of these correlations suggests that while the separate domains are meaningfully related, they were not redundant items/scales. The correlations between the overall quality of life scale and the four health domain scales ranged from 0.34 (with physical state) to 0.58 (with life enjoyment) “presently,” with a similar pattern of higher values “before Network” (0.42 - 0.68). The correlations between the overall quality of life and combined wellness scale were 0.74 “before Network” and 0.66 “presently,” again suggesting that they are meaningfully related but not redundant.

To further explore the characteristics of this *combined wellness scale*, both “before Network” and “presently,” factor analysis combining all items from the four health domains was conducted. The results support the conclusion that the combined set of all items measured a single phenomenon or “wellness theme” with factor loadings consistently exceeding 0.3 (criteria described above); this conclusion also derives from the fact that the theta reliability of the *combined wellness scale* is higher than the reliability of the separate health domain scales. However, further inspection of the factor scores did reveal a pattern wherein the items within the respective domains tended to cluster together identifiably after removing the primary variance. Thus, even though the *combined wellness scale* is slightly more reliable and more strongly in accord with the overall quality of life index, additional information is available by considering the (sub-) scales separately. In addition, there is some statistical evidence, in the magnitude of the second factor scores, that the life enjoyment scale may represent a second theme somewhat distinct

Table 4. Perceived Changes (Difference Scores) in Self-Rated Health/Wellness and Quality of Life Scales Between “Before Network” and “Presently” (N ≥ 2596)

INDEX	Difference Scores		Improved*	Paired t-test p value	Effect Size
	Mean	St Dev			
Combined Wellness	+ .171	.136	76.4%	.000	1.24
A. Physical State	+ .144	.128	63.9%	.000	0.94
B. Mental/Emotional State	+ .173	.163	64.3%	.000	0.91
C. Stress Evaluation	+ .194	.196	66.2%	.000	0.98
D. Life Enjoyment	+ .167	.164	68.9%	.000	1.15
Overall Quality of Life	+ .158	.168	58.9%	.000	0.93

\* Positive change greater than  $\pm 0.5$  standard deviation, corresponding to a moderate or greater effect size.

from that shared by the physical state, mental/emotional state, and stress evaluation constructs. Accordingly, results are presented for both the separate health domains and the *combined wellness scale* in the remainder of this report.

#### Retrospective Outcomes Assessment.

These scales were used for the evaluation of retrospectively perceived changes in self-rated health and quality of life for patients under Network Care (Table 4). For each individual, perceived change was calculated as the difference between “presently” and “before Network” scores. For every outcome measure, the mean difference score was positive, indicating that for all scales, on average, there was reported improvement with care. The perceived change (difference) in scores of the *combined wellness scale* (“*wellness coefficient*”) indicated an average of + 0.17 in a range of -1 to +1. This was interpreted as an overall increase in wellness as the value was consistent with statistically significant differences in the scale scores and positively (+) signed (numerically closer to +1 than -1). In regard to the separate health domains, the differences between “presently” and “before Network” were also all positive and in the same range as the *wellness coefficient* (Table 4). The magnitude of these perceived changes varied from +0.14 to +0.19, which compares to a +0.16 increase for the overall quality of life index.

The results of two-tailed paired sample t-tests indicate that these perceived changes (i.e., differences between “presently” and “before Network” scores) were statistically significant for all outcomes ( $p < 0.000$ ); demonstrating that the differences in scores were not due to chance fluctuations. The effect size statistics further showed that these improvements (ranging from 0.91 to 1.15 across the separate scales) were above 0.8, indicating that a large positive clinical outcome had occurred across all domains. In addition, there was notable correspondence between the separate health domains derived for the purpose of this study and the standardized overall quality of life index (Table 4).

The advantage of retaining the separate domains of physical state, mental/emotional state, stress evaluation, and life enjoyment, as well as the *wellness coefficient*, becomes apparent in comparing range of effect sizes for these outcomes. Retrospectively perceived changes associated with physical state, mental/emotional state, and stress evaluation are comparable in magnitude with overall quality of life assessments (range=0.9-1.0). In contrast, the change in life enjoyment is notably greater (1.15).

Moreover, when all scales are combined in the *combined wellness scale*, the effect size calculation shows a large (1.24) positive clinical effect associated with Network Care (Table 4).

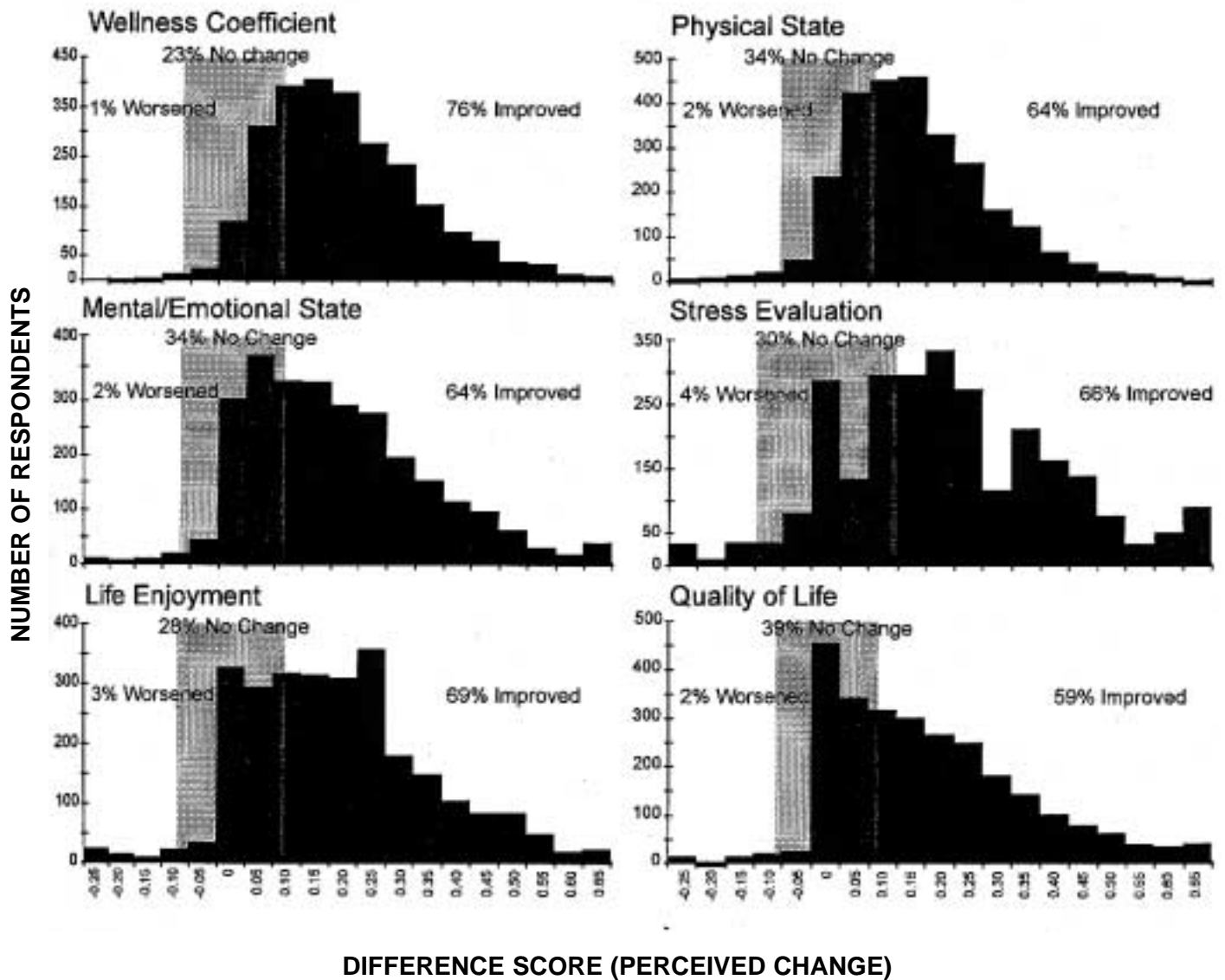
To better visualize clinical improvement in outcomes, Figure 1 illustrates the self-perceived change histograms for each index, with each data point in the histogram representing the difference score for an individual. The cut-offs for the categorization of each respondent as worsened, no change, or improved are shown superimposed, and ranged from  $\pm 0.07$  for life enjoyment to  $\pm 0.10$  for mental/emotional state and stress evaluation. Across all scales, 4% or less of respondents reported decreased levels of self-rated health, wellness, and quality of life, and between one-fourth and one-third did not change beyond one-half standard deviation within the scale. In contrast, as also noted in Table 4, the majority of respondents reported at least a moderate clinical improvement across all outcome assessments. In spite of the conservative cut-off values, 59% improved on the overall quality of life index, and about two-thirds of respondents showed clinical improvements in physical state, mental/emotional state, stress evaluation, and life enjoyment indices, with over 76% perceiving improvement in the wellness coefficient.

#### Analyses of Outcomes by Duration of Care

While the variable representing length of time since beginning Network Care in months, i.e., duration of care, was significantly skewed toward the lower range, the re-scaled version representing duration intervals of 1-3, 3-12, 12-36, and 36+ months was normally distributed (i.e., not significantly skewed). Table 5 presents the means, standard deviations, and effect sizes “presently” and “before” Network Care for each of the four health scales, the *combined wellness scale*, and overall quality of life, for the four duration of care intervals.

ANOVA results showed that the mean “presently” scores differed statistically ( $p < 0.003$ ) across the duration groups for all self-rated health and quality of life scales, as well as the *combined wellness scale*, indicating that increasing duration of Network Care is significantly associated with increasing levels of perceived health and wellness. Although this pattern is meaningful in itself, the retrospectively recalled “before Network” scores in the four health domains, the *combined wellness scale*, and overall quality of life also provided the opportunity to examine the relationship between possible perceived changes in health and wellness and length of time since starting care; i.e., how stable is the





**Figure 1** illustrates the self-perceived change histograms for the wellness coefficient, each health scale, and overall quality of life. Data points in the histogram represent the difference scores for each individual (e.g. difference between “presently” and “before Network”) for each scale. The percentages of patients who worsened or improved more than one half of the standard deviation ( $\pm 0.5$  SD), or had no change (stippled areas in figure) are superimposed over each histogram. The specific cutoff values for improvement thus vary as a function of the distribution and variability of each index. The cut off values ranged from  $\pm 0.06$  for physical state to  $\pm 0.10$  stress evaluation.

reliability of retrospective recall of one’s health given varying time intervals?

To begin to address the validity of the retrospective recall strategy, the within group variation (standard deviation) in “before Network” scores in all scales was examined (Table 5). This differed only minimally across these duration groups, and showed no pattern of increased variability with increased duration of care (i.e., length of recall). Moreover, the reliability coefficients were strikingly similar across duration groups, varying in magnitude by 1% or less for all scales (except physical state at 2.5%), and showed no trend toward lower reliability associated with increased length of retrospective recall. Thus, a longer interval since “before Network” is not associated with increased random error in the measurement of quality of life, self-rated health, or wellness in these data.

ANOVA results indicated that the mean “before Network” scores for overall quality of life, stress evaluation, life enjoyment, and the combined wellness rating were significantly different across the duration groups ( $p < 0.003$ ). In each instance, the “before Network” wellness scores were lower with longer intervals in care.

The *wellness coefficient*, being the difference between “presently” and “before Network,” reflected in one measure the incrementally lower “before Network” wellness ratings concomitant with the progressively higher “presently” scores, observed with longer intervals in care. Moreover, the self-rated health scales, *combined wellness scale*, and overall quality of life across the duration groups showed significant positive differences (improvement). As is readily apparent in Figure 2, respondents within groups, defined by increasingly longer duration of care, report-

Table 5. Duration of Network Care Reliability Analyses for “Before Network” and “Presently” Self-Rated Wellness and Quality of Life Scales (N ≥ 2330).

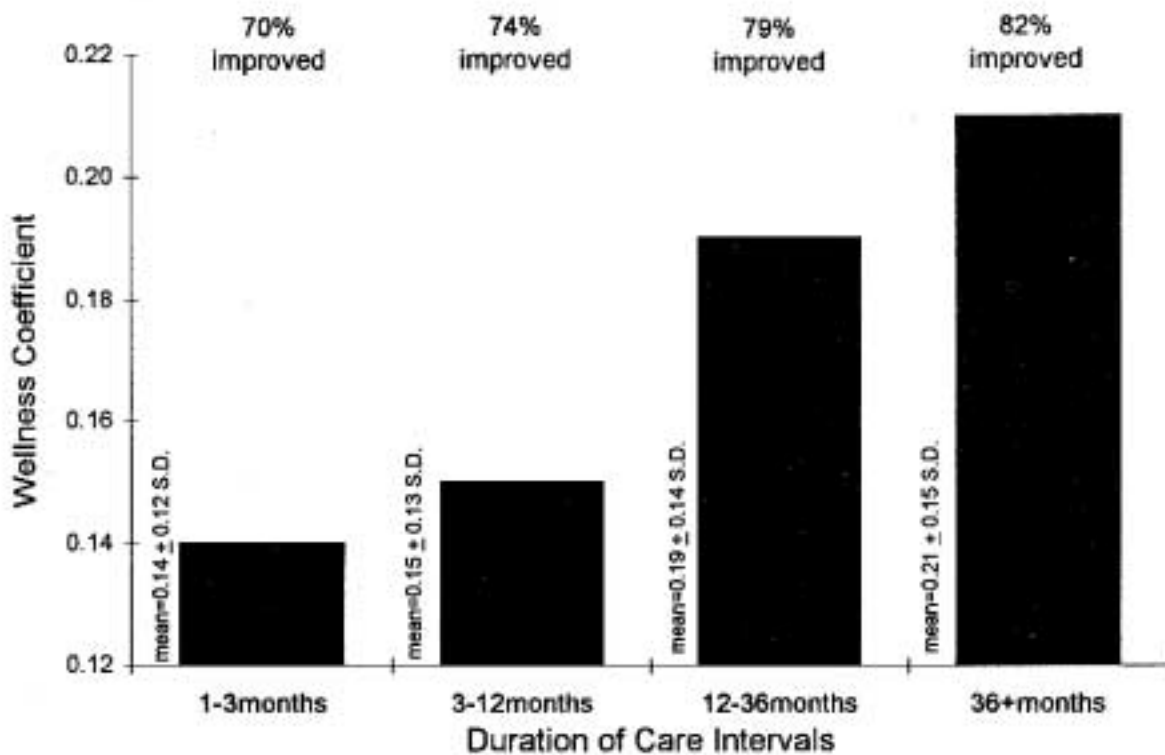
		“Presently”		“Before Network”		Alpha	Effect Size
		Mean	St Dev	Mean	St Dev		
Combined Wellness							
In Care	1-3 mo.	.665	.102	.526	.136	.953	1.03
	3-12 mo.	.669	.096	.517	.135	.951	1.13
	12-36 mo.	.680	.099	.495	.139	.956	1.33
	> 36 mo.	.702	.098	.482	.139	.954	1.54
A. Physical State							
In Care	1-3 mo.	.691	.123	.568	.152	.773	.81
	3-12 mo.	.695	.115	.562	.153	.747	.87
	12-36 mo.	.705	.119	.551	.156	.841	1.00
	> 36 mo.	.717	.124	.555	.154	.754	1.08
B. Mental/Emotional State							
In Care	1-3 mo.	.650	.144	.508	.187	.859	.76
	3-12 mo.	.653	.135	.497	.185	.856	.84
	12-36 mo.	.673	.134	.489	.191	.867	.97
	> 36 mo.	.686	.130	.476	.196	.858	1.09
C. Stress Evaluation							
In Care	1-3 mo.	.670	.153	.514	.196	.834	.79
	3-12 mo.	.668	.152	.497	.196	.838	.89
	12-36 mo.	.667	.156	.462	.199	.841	1.10
	> 36 mo.	.698	.150	.462	.199	.838	1.24
D. Life enjoyment							
In Care	1-3 mo.	.646	.135	.517	.150	.847	.85
	3-12 mo.	.656	.138	.516	.143	.836	1.00
	12-36 mo.	.677	.135	.489	.143	.838	1.13
	> 36 mo.	.700	.128	.478	.139	.816	1.59
Overall Quality of life							
In Care	1-3 mo.	.670	.147	.561	.177	.942	.61
	3-12 mo.	.693	.136	.566	.165	.942	.78
	12-36 mo.	.704	.145	.524	.174	.948	1.00
	> 36 mo.	.735	.134	.518	.168	.943	1.31

ed incrementally higher positive *wellness coefficients*. That is, not only were the changes between “presently” and “before Network” scores statistically significant for all outcomes, but the extent of that change in the *wellness coefficient* is positively associated with the duration interval of care. Moreover, the percent of respondents exhibiting a greater than moderate clinical effect also increased with increased duration of care.

To further explore the association between wellness and duration of care, two-tailed paired sample t-tests were conducted on the change between “presently” and “before Network” scores for the *combined wellness scale*, and overall quality of life, separately within each duration of care group. Regardless of the time interval since beginning Network Care, the mean combined wellness improvement was statistically significant. Additionally, progres-

sively higher effect sizes were evident across the four categories of duration of care in nearly proportional increments; 1.03 for 1-3 months, 1.13 for 3-12 months, 1.33 for 12-36 months, and 1.54 for 36+ months of Network Care. A similar pattern was obtained for the overall quality of life index (Table 5).

These proportionally increasing effect sizes (about 0.1 per year of care) suggest that these particular intervals are meaningful time categories, perhaps connected to the accrued benefits of care. Thus, even for respondents who began care within three months of completing the survey, the statistic is well above the 0.8 value indicating a large clinical treatment effect; for those in care more than 3 years, the effect size is nearly double this benchmark. This systematic difference reflects clinically meaningful retrospectively perceived improvements in self-rated



**NOTE: Improved is + >0.5 standard deviation of baseline scores**

**Figure 2** shows mean wellness-coefficients versus duration of care. Respondents within each group, defined by increasingly longer duration of care, reported incrementally higher, positive wellness coefficients. The percent of “improved” respondents, defined as those greater than one half of the standard deviation of each duration of care category, are also indicated; note that the percent “improved” also increased in each of the duration of care intervals. These percentages represented a greater than moderate clinical effect.

health, wellness, and overall quality of life, associated with Network Care.

### Discussion

A primary objective of this study was the evaluation of retrospectively perceived changes in self-rated health and quality of life for patients undergoing Network Care. The results from analyses of 2,818 respondents has provided compelling evidence for the beneficial effects of Network Care. This population of patients undergoing Network Care self-rated their status “presently” at a level of 0.7 (70%) in a metric of 0 - 1.0, and were “mostly satisfied” with their quality of life. This was a statistically significant increase over their self-reported wellness “before Network” which averaged about 0.5 (50%), and, on average, had “mixed” satisfaction about their overall quality of life. Over 76% of respondents reported positive, clinically significant *wellness coefficients*, incorporating perceived changes in physical state, mental/emotional state, stress evaluation, and life enjoyment. Categorizing patients in terms of duration of care revealed progressively higher reported effects with time under Network Care.

The precise mechanisms underlying these effects are uncertain, but it is hypothesized to be, in part, associated with changes in levels of circulating factors released by the pituitary-adrenal cortical axis. While this hypothesis will be tested in subsequent studies, by analogy, such changes have been associated with the relaxation response during meditation<sup>29-30</sup> and stress-reduction programs.<sup>31-38</sup>

### The Survey Population

This first census of active practitioners of Network Care realized a 49% participation by ANC practitioners. Given the practitioner participation rate, coupled to the strong statistical power of the findings, conditions contributing to a positive bias could be operational. However, respondents to a separate practitioner survey (conducted during the same time frame) indicated that among 116 respondents, 97% followed the suggested protocols outlined for Network Care. This implies that Network Care is practiced consistently. Moreover, since the patient responses were received from 156 different practices, widely distributed across the range of practice locales, there is no prevalent rationale which would suggest that practitioner participation was biased. Nevertheless, further study investigating the impact of

practice style on patient outcomes will be necessary to better understand this issue. On a practical note, if indeed the sample is biased towards results obtained by practitioners more committed to health care delivery, then the present results should be viewed as a "benchmark" against which new practitioners could set practice goals and objectives.

Based on population parameters and inclusion criteria, the estimated survey response rate of 67–71% is generally considered to be "very good" particularly for mail surveys.<sup>39</sup> Although the overall response rate is in the acceptable range, it is important to ascertain as much information as possible regarding non-respondents in order to detect other systematic bias. The telephone follow-up with practitioners confirmed some reluctance to participate on the part of patients for reasons of time constraint, privacy and/or disinterest in the study, but not for reasons that might bias the results (e.g., only the best patients, or those receiving the greatest amount of care, etc.). It is difficult to estimate the number of patients declining to participate for reasons of adverse reactions or poor outcomes. However, among those responding, there was a small number ( $n = 29$ , 1%) who indicated that they would not be continuing Network Care. Those choosing not to continue care reported the smallest (but still significant) improvements in the indices for physical state and mental/emotional state, although no significant change from base line was detected in this group with regard to the remaining three indices (stress evaluation, life enjoyment, and quality of life). While it is believed that "self selection" bias is not a significant feature of the present study due to its wide range of participating practices, a longitudinal study is currently underway to assess patients from the onset of care through a specified time period. This approach will provide the opportunity to ascertain if only those receiving positive benefits from care "self select" as survey respondents by evaluating non-respondents, as well, relative to their clinical benefit status.

The first objective of this study was to characterize the population under Network Care. The vast majority of the population studied are from offices within the United States (93.5%), with a small representation from Canada (4.6%), Australia (1.0%), and Puerto Rico (0.8%). Given the international scope and other inclusion criteria defining this population, it is difficult to relate directly to the U.S. population. Although the age of respondents appears to be normally distributed, the average of 43 years is higher than the national mean (35 years),<sup>40</sup> and is likely because of the exclusion of patients less than 17 years of age as well as the lower incidence of health care utilization in early adulthood. There were clearly more female than male respondents, and the population was predominantly white. Socioeconomic characteristics of these respondents tended to be skewed toward higher education levels, professional/technical occupations, and higher income. These patterns have also been noted in studies of alternative/complementary medicine in the U.S. and Europe,<sup>41–43</sup> as well as studies of chiropractic care.<sup>44–45</sup> Whether or not the results of this study extrapolate to the general population awaits further investigation.

A more interesting challenge is to attempt to understand the factors contributing to the uniqueness of the population under Network Care. The cost of care may be one factor. There is a

high incidence of self-pay with patients undergoing Network Care. The fee for an office visit varies greatly depending on practice size, location, pay plan (individual, family, monthly, weekly, etc.), but ranges from approximately \$15–\$50 per visit. Given the frequency of care, i.e., ca. 2 times/week (Table 2), this amounts to about \$120 to \$400 per month. While this is consistent with the approximate amount paid by Americans for health insurance and out-of-pocket expenses for alternative/complementary care,<sup>41</sup> other studies document the strong negative correlation between family income and access to health care,<sup>46</sup> and by analogy, cost may restrict access to Network Care. In terms of ethnicity, the lower family incomes among ethnic minorities may account for the limited access of these groups to the health care structure in general.<sup>47</sup> Other factors such as cultural attitudes and health belief structures are strong determinants of access to health care,<sup>48–49</sup> and need to be examined within the context of Network Care. Finally, the high incidence of females in the present population (73%) relative to the general population (51%) is consistent with health care utilization patterns in general<sup>50–51</sup> and is currently undergoing further study.

#### *Study Design*

Although there are a number of objective criteria for assessment of vertebral subluxation such as surface electromyographic recordings and thermography, which may be applied to the analysis of patients under Network Care, these objective criteria do not take into consideration the overall health and wellness status of the patient. For this reason, it was important to assess the broader issues by use of self-rated health, and overall quality of life (see Introduction for details).

Self-rated health measurements are used with increasing frequency as measures of primary and secondary outcomes in clinical studies, and in a growing number of studies, have been shown to be an impressive, independent predictor of outcomes, including mortality and longevity.<sup>10</sup> All self-reported survey data is subject to potential response effects, such as when respondents provide socially desirable responses, or are inclined to respond similarly to all items (common method variance). In the present data, these issues do not appear to be particularly problematic; arguing against socially acceptable responses is the observation that actual responses included the range of possible scores, and the issue of common method variance error is negated because summated scales showed greater variability than the separate original items. Also, analyses of cases with missing values on the outcome assessments did not reveal non-response to be a systematic biasing factor.

In the present study, self-rated health was used as an evaluative instrument to measure perceived change in patient perceptions, "presently" relative to "before Network." The patients' self-reported assessments of their prior status before initiating Network Care allowed analysis of perceived trends over time, but not specific cause-effect relationships. Although the cross-sectional design holds advantages for the purposes of this study, longitudinally collected data is necessary to verify time-related changes (e.g., with duration of care).

The ability of an evaluative instrument to detect change (i.e., responsiveness) can be compromised by floor/ceiling effects in which patients with the best scores may continue to improve

(beyond the scope of the response range), or the health status of patients on the low end of the scale continue to worsen. No floor effects were encountered. Although examination of the data revealed potential operation of ceiling effects, further investigation showed less than 2% of cases could be considered suspect (>95% of maximum), with trivial attenuation of outcomes.<sup>d</sup> Thus, this wellness survey demonstrates sensitivity for measuring improvements in an already healthy population.

#### *Validation of survey instrument*

The second objective of the study was the development and validation of a wellness-specific survey instrument. Reliability analyses showed high levels of internal consistency for the physical state, mental/emotional state, stress evaluation, and life enjoyment scale items, indicating that each scale represents a dependable and interpretable measure of its respective theme. The notably, but not problematically, lower alpha coefficient for the physical state scale is not unanticipated given the relatively greater substantive diversity of questions in this scale; it is not necessarily expected that the presence of allergy, for example, will co-occur to a great degree with flexibility of the spine. Moreover, the high reliability of the *combined wellness scale* suggests that efforts to formulate a broad and coherent wellness assessment reflecting the WHO definition of health were realized. The reliability coefficients obtained in this sample for the overall quality of life scale were comparable to values obtained in prior studies with this instrument.<sup>12,52</sup>

#### *Validation of retrospective recall*

The strategy developed in this study of asking respondents to retrospectively recall their level of health and wellness before initiating Network Care as well as “presently,” represents an integration of the classic pre-post study design with the increasingly recognized importance of assessing health interventions in terms of “patient-centered” outcomes. The differences between the standard deviations and reliability coefficients for the “before Network” scales compared to those for the same scales measured “presently,” do not appear to be substantial, suggesting only the increased complexity of the cognitive process involved in recalling prior levels against the standard of present experiences. Moreover, the scale properties across the duration of care groups showed no trend toward greater variability or lower reliability associated with increased length of retrospective recall.

#### *Retrospective Outcomes Assessment*

The third objective of the present study involved a retrospective outcomes assessment using the data derived from the survey. Results show that statistically and clinically significant changes occurred within the respondent population regarding self-rated health outcomes and quality of life “before Network” and “presently.” In this regard, the 70–76% of respondents reporting moderate to large improvement in the four scales of health assessment, and 59% of respondents reporting such improvement in overall quality of life, and effect sizes about 0.9 (clearly exceeding the benchmark for large clinical significance for every measure), substantiate the health promoting premise of Network Care.

Exploration of these perceived health improvements over given time intervals yielded suggestive evidence for the long-term benefits of Network Care. Across the four duration of care groups, progressively higher percentages of respondents (70%, 74%, 79%, 82%) reported clinically meaningful improvement in every measure. Moreover, clinical effect sizes across the four durations of care, averaging a range of 0.8 to 1.2 for the four domains of health assessment, and 0.6 to 1.3 for overall quality of life, attest to perceptions of consistently greater benefits of care as a function of duration of care. This finding also has implications in regard to the concept of maximum clinical benefit, which presupposes a “leveling off” effect.<sup>11</sup> On the contrary, the current findings regarding Network Care suggest that clinical benefits accrue over time, with no indication of a maximum in excess of three years of care.

Similarly, the “*wellness coefficient*,” representative of the difference between the *combined wellness scale* ratings “before Network” and “presently,” increased systematically as a function of duration of care. This indicated a continuum of improvement in overall “wellness” while under Network Care, initiated even among those respondents who began care within three months of completing the survey. Even more striking were the proportionally increasing clinical effect sizes across the four duration of care intervals (about 0.1 per year of care), indicating improvement in every index of health measured in this study.

This continuum of improvement in the “*wellness coefficient*” not only reflected the progressively higher “presently” ratings across the four duration of care intervals, but also a progressively lower self-rating of “before Network” scores. This might suggest that those respondents who remained in care longer were in poorer health before initiating Network Care. However, other available information does not support this conclusion. In particular, the overall ranking of health (Table 2, Item I.1) and whether or not the respondent had ever injured their spine, or experienced a physical or emotional trauma, was not significantly associated with duration of care group.

What then accounts for the downgrading of self-reported health status as a function of the duration of retrospective recall? It appears that these broad, patient-centered health measures detect advancements in wellness such that respondents have a new standard against which to gauge their recalled “poorer” levels of health. The interesting exceptions to this pattern were the “before” scores for physical and mental/emotional state which were not significantly different across the four duration of care intervals. Perhaps these more concrete domains are less susceptible to perceptual shifts, and/or are perceived as less relevant to the overall experience of wellness. Further research in regard to the broad concept of health, expressed in the WHO definition, will need to examine the content validity, or differences and relationships between the various domains of health contributing to experienced wellness.

#### *Construct Validity*

In regard to self-reported health, as with other outcome measures such as pain, quality of life, and depression, there is no “gold standard,”<sup>35</sup> or universe of content accepted as totally adequate to define the quality being measured.<sup>19</sup> Thus, the process of instrument validation “requires a pattern of consistent find-

ings involving a number of different researchers using different theoretical structures across a number of different studies.”<sup>19</sup>

While ongoing longitudinal studies will assess the present instrument on a more global basis, the process of estimating its construct validity has begun through the development of a conceptual basis for measuring the theme of “wellness.” This was accomplished by incorporating aspects of the WHO definition of health including physical, mental, and social well-being. As anticipated, individuals provided a broad base of information by retrospectively assessing their health “before Network” relative to their present status under Network Care. This permitted conclusions to be drawn regarding perceived change in health through a “*wellness coefficient*,” representing the retrospectively perceived difference in the combined domains of all four reported health scales, which were shown to representatively support and validate a principal theme. Nevertheless, the results from factor analysis suggest that the life enjoyment domain (representing the most understudied aspect of the WHO definition) is somewhat unique in these data, and the effect size for this scale indicates that life enjoyment may be a particularly important aspect of health contributing to perceived wellness. Overall, the *wellness coefficient* as an outcome of Network Care demonstrates clear internal validity.

Since the instrument was comprised of scales surveying established indicators of health status, as well as incorporating a reference scale assessing quality of life, a basis for further evaluation of its external reliability and construct validity was provided. The *combined wellness scale* demonstrated convergent validity with the overall quality of life scale. That is, these separate and combined self-rated health scales produced results comparable to the overall quality of life scale, while the reported reliability coefficients are consistent with those for this same scale applied to a wide variety of subjects in other studies.<sup>12, 14, 15, 52</sup>

While validation of the survey instrument will require its continued application in a variety of settings, initial findings indicate the instrument has a high level of sensitivity in measuring the central theme of “wellness,” is reliable, and exhibits internal and external construct validity.

## Summary and Conclusions

Findings of the present study elaborate the importance of characterizing and investigating the efficacy of this non-medical health care practice in accord with its specific objectives. In that regard, evidence is provided which shows that Network Care:

1. Is utilized by a unique population, with socioeconomic, gender distribution, and educational characteristics similar to those seeking other forms of health care different from orthodox medicine.
2. Is associated with significant “retrospectively recalled” improvement in self-rated perceptions of health, wellness and overall quality of life.
3. Results in a large (>0.9) positive clinical effect in every health-related domain investigated.
4. Is associated with significant improvement in self-rated perceptions of “wellness,” positively correlated with length of time under Network Care.

Within the boundaries of the study design, these findings

provide substantial evidence that Network Care should be included among those practices with established health benefits.

Results of this study have been presented in a manner which permit comparison with data to be derived from continuing longitudinal study of Network Care, as well as future studies of other non-medical health related approaches. Moreover, the newly developed survey instrument, which has initially shown a high level of validity in measuring an underlying “wellness” theme, is an important contribution to further study of the holistic definition originally proposed by the World Health Organization. Repeated use of the survey instrument, or its component scales, by both the non-medical and medical communities, will serve to test its validity as a means through which information can be acquired linking self-rated perceptions of wellness to a variety of health issues.

These initial findings show that Network Care is associated with significant improvement in all indicators of health evaluated, and demonstrate a strong association between Network Care and self-reported, positive change in overall health/wellness. Although these findings are supportive of Network Care, they must be interpreted within the boundaries of a cross-sectional study, i.e., lack of test-retest responses and no control population. For this reason, longitudinal studies, with repeated measures should be undertaken to provide a more thorough assessment of changes over time. The next phase of research underway, involves a longitudinal study to provide such long-term assessment of patients and controls to evaluate dynamic behavior and perceptions of patients under Network Care. This longitudinal study will be combined with laboratory research involving EMG analysis, changes in stress-related hormones, immuno-chemical profiles, computerized platform posturography, and mathematical modeling to further elucidate the neurological/physiological mechanisms underlying Network Care.

## Endnotes

<sup>a</sup> The re-scaling involved simple linear transformations. Each index was created by first summing the equally weighted items (ranging from 9-14) scores to yield composites with theoretical ranges between  $n$  (number of items) and  $n$  times  $p$  (the number of points on the Likert scale — 5 or 7). The transformation was of the form  $I_{trans} = (I - n)/(pn - n)$ , where  $I$  is the index in its original metric and  $I_{trans}$  is the transformed index.

<sup>b</sup> Using this conservative strategy, approximately 8% of cases were considered missing on this all domains wellness scale, with most missing on more than one sub-scale. While this is not a problematically high percentage, nevertheless, non-responders were compared to responders in terms of all otherwise available information. No significant differences were found in sociodemographic, health, or health/chiropractic care characteristics which would systematically bias the results of the outcomes assessment.

<sup>c</sup> In addition, because of a perceptible degree of positive skewness in the items/scales, which would violate the statistical assumption of normality, non-parametric versions of all bivariate statistics were also obtained. In every case, the numerical results were highly similar, and substantive results identical.

Based on a desired probability of 0.95 to find a 20% before/presently difference (with a standard error of 2%) to be statistically significant at the 99% confidence interval, calculations indicate a minimum of 21 cases were required.<sup>23</sup> Clearly the bias of small sample size is not an issue in this investigation.

<sup>d</sup> The individual items making up the summated scales show some tendency toward positive skewness on the response code metric (mean scores above the

midpoint of the range), opening the possibility for the operation of these ceiling effects, which can attenuate the difference scores and thus the empirical magnitude of Network Care effects. One advantage of scaling the set of items is that the procedure can diminish this deviation from normality by capturing additional variability across the set within each individual's scores. Among the "before Network" summated scales, only physical state and quality of life show this above midpoint mean; although all of the "presently" scales are more positively skewed toward wellness, the mean is nevertheless well below maximum. Moreover, the number of potentially affected cases (i.e., those with summated scale scores above 80% of maximum "before Network") was estimated to be at or less than 5.7% of respondents for the individual scales, and only 1.4% (36) cases for the all domains wellness scale. While the mean wellness change score was clearly lower for these small groups than for the sample overall (indicating the operation of ceiling effects), the number of these cases at the maximum presently score (0.95+) was less than 1% , with less than 2% of the overall sample scoring at or above this upper level on present wellness.

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## APPENDIX

Self-Rated Health Scales: The following domains and items were used to assess health, wellness and overall quality of life.

### I. Physical State

“Rate the following questions on a frequency scale of 1 to 5, with 1 = never, 2 = rarely, 3 = occasionally, 4 = regularly, 5 = constantly.”

1. Presence of physical pain (neck/back ache, sore arms/legs etc.)
2. Feeling of tension or stiffness or lack of flexibility in your spine.
3. Incidence of fatigue or low energy.
4. Incidence of colds and flu.
5. Incidence of headaches (of any kind).
6. Incidence of nausea or constipation.
7. Incidence of menstrual discomfort.
8. Incidence of allergies or eczema or skin rashes.
9. Incidence of dizziness or lightheadedness.
10. Incidence of accidents or near accidents or falling or tripping.

### II. Mental/Emotional State

“Rate the following questions on a frequency scale of 1-5, with 1 = never, 2 = rarely, 3 = occasionally, 4 = regularly, 5 = constantly.”

1. If pain is present, how distressed are you about it.
2. Presence of negative or critical feelings about yourself.
3. Experience of moodiness or temper or angry outbursts.
4. Experience of depression or lack of interest.
5. Being overly worried about small things.
6. Difficulty thinking or concentrating or indecisiveness.
7. Experience of vague fears or anxiety.
8. Being fidgety or restless; difficulty sitting still.
9. Difficulty falling or staying asleep.
10. Experience of recurring thoughts or dreams.

### III. Stress Evaluation

“Evaluate your stress relative to the following, with 1 = none, 2 = slight, 3 = moderate, 4 = pronounced, and 5 = extensive.”

1. Family.
2. Significant Relationship.
3. Health.
4. Finances.
5. Sex Life.
6. Work.
7. School.
8. General well-being.
9. Emotional well-being.
10. Coping with daily problems.

### IV. Life Enjoyment

“Rate the following questions on a degree scale of 1-5, with 1 = not at all, 2 = slight, 3 = moderate, 4 = considerable, 5 = extensive.”

1. Openness to guidance by your “inner voice/feelings.”
2. Experience of relaxation or ease or well-being.
3. Presence of positive feelings about yourself.
4. Interest in maintaining a healthy lifestyle (e.g., diet, fitness, etc.).
5. Feeling of being open and aware/connected when relating to others.
6. Level of confidence in your ability to deal with adversity.
7. Level of compassion for, and acceptance of, others.
8. Satisfaction with the level of recreation in your life.
9. Incidence of feelings of joy and or happiness.
10. Level of satisfaction with your sex life.
11. Time devoted to things you enjoy.

### Overall Quality of Life (Woodruff and Conway, 1992)

“Evaluate your feelings relative to the quality of your life with 1 = terrible, 2 = unhappy, 3 = mostly dissatisfied, 4 = mixed, 5 = mostly satisfied, 6 = pleased, 7 = delighted.”

1. Your personal life.
2. Your wife/husband or (significant other).
3. Your romantic life.
4. Your job.
5. Your co-workers.
6. The actual work you do.
7. Your handling of problems in your life.
8. What you are actually accomplishing in your life.
9. Your physical appearance - the way you look to others.
10. Your self.
11. The extent to which you can adjust to changes in your life.
12. Your life as a whole.
13. Overall contentment with your life.
14. The extent to which your life has been what you wanted it to be.