

# “I know it’s changed”: a mixed-methods study of the meaning of Global Perceived Effect in chronic neck pain patients

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## Abstract

**Purpose** Global Perceived Effect (GPE) is a commonly used outcome measure for musculoskeletal conditions like neck pain; however, little is known regarding the factors patients take into account when determining their GPE. The overall objective of this work was to describe the thematic variables, which comprise the GPE from the patient’s perspective.

**Methods** This was a mixed-methods study in which qualitative data were collected within a randomized clinical trial assessing exercise and manual therapy for chronic neck pain. A consecutive sample of 106 patients who completed the trial intervention took part in semi-structured interviews querying the meaning of GPE. Quantitative measures were collected through self-report questionnaires. Interview transcripts were analyzed using content analysis to identify themes, which were then quantified to assess potential relationships.

**Results** A model of GPE for chronic neck pain emerged comprised of five main themes: neck symptoms (cited by 85 %), biomechanical performance (38 %), activities of daily living (31 %), self-efficacy (10 %), and need for other treatment (6 %). Influencing factors included those contributing to GPE: treatment process (64 %), biomechanical performance (51 %), self-efficacy (16 %), and the nature of the condition (8 %). Factors, which detracted

from GPE or prevented recovery included perceived nature of condition (58 %), required daily activities (10 %), lack of diagnosis (5 %), and history of failed treatment (5 %). **Conclusions** GPE appears to capture chronic neck pain patient perceptions of change in different domains important to their individual pain experiences that may not be captured by other outcome instruments. Thus, GPE is a suitable patient-oriented outcome that can complement other measures in research and clinical practice. Importantly, many chronic neck pain patients believe it impossible to reach complete recovery because of a perceived intractable aspect of their neck condition; this has important implications regarding long-term disability and health-seeking behaviors.

**Keywords** Neck pain · Outcomes assessment · Patient-centered care · Rehabilitation

## Introduction

Given the widespread prevalence and economic impact of neck pain [1–4], it is essential we gain a greater understanding of what being “better”, “improved” or “recovered” means to neck pain sufferers. Single-item, Global Perceived Effect (GPE) scales are commonly advocated for use in chronic pain research and clinical practice [5]. Also known as global rating, overall improvement and recovery scales, the GPE instruments are appealing in that they are easy to administer and score. They also have the potential to capture, in an overall sense, the aspects of recovery or improvement that are most meaningful and relevant to individual patients [6, 7]. Little research, however, has been done exploring the factors patients consider when determining their GPE.

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An underlying assumption of the GPE is that it measures a composite assessment of multiple domains related to the perceived improvement of one's chief complaint. This is supported by qualitative research demonstrating that low back pain patients cognitively appraise their symptoms, daily activities and quality of life when considering their recovery [8]. This is likely similar for those suffering from neck pain, where multiple factors have been shown to impact patients' experiences and behaviors [9]. Given the widespread use of the GPE and its potential complexity, a conceptual model which demonstrates the GPE's relationships with other neck pain-related domains may prove useful in better understanding patients' priorities and optimizing treatment outcomes.

A greater understanding of GPE may also aid with the interpretation of clinical trial results and better informed health policy decisions. Currently, it is not clear which factors patients consider when assessing their GPE and what this measure represents to them. Does the GPE reflect changes captured in other outcome measures? Or are there other factors patients consider when assessing their improvement? Uncertainties such as these make it difficult to know how much weight to place on GPE as an outcome measure when interpreting clinical trial results. Further, a better understanding of how patients view GPE might lead to the refinement of existing patient-oriented outcome measures, and possibly the development of new ones.

The overall objective of this work was to provide a deeper understanding of GPE in chronic neck pain patients. More specifically, using a mixed-methods approach, we aimed to describe the thematic variables which comprise the GPE from the patients' perspective, and explore underlying factors. We also sought to use this information to better interpret the results of the parent randomized clinical trial (RCT) in which the patients took part.

## Materials and methods

This work is part of a mixed-method study in which qualitative methods were embedded in a parent randomized clinical trial (RCT) [10, 11]. The study was approved by the institutional review boards of the participating institutions and consent was received from all participants. Our premise was that qualitative methods of data collection and analysis were the most appropriate for achieving our goal of exploring patients' perspectives and experiences related to measuring GPE [10]. Additionally, quantitative methods were required to assess the frequency of specific GPE-related themes in chronic neck pain patients and identify potential patterns which could explain the parent trial results. The qualitative aspects were considered supplementary to the RCT. Our process was pragmatic and

iterative, incorporating both deductive and inductive approaches [10].

The primary objective of the parent RCT was to assess the effectiveness of 12 weeks of supervised exercise plus spinal manipulation, supervised exercise alone, and home exercise for chronic neck pain; the methods and results are described in detail elsewhere [11]. A secondary objective was to assess patients' perceptions related to GPE. Specifically, we aimed to answer the following questions: what factors do chronic neck pain patients take into account when determining their GPE? To what do they attribute change or lack of change in their condition? Do they think it is possible to completely improve or recover?

## Participants

A consecutive subset of participants who completed the 12-week intervention phase of the parent RCT were invited to take part in an interview [11]. To participate in the RCT, participants had to be 18–65 years of age, with a primary complaint of mechanical, non-specific neck pain [12, 13]. Prior to RCT enrollment, participants had to have a continuous episode of self-reported neck pain for at least 12 weeks, with a severity of 3 or greater (0–10 numerical rating scale).

We aimed to sample at least 100 of the 271 participants in the RCT, to ensure a complete range of neck pain patients, with equal representation from each of the treatment groups. We anticipated this would be sufficient for reaching saturation, or the point where no new themes would emerge from our analysis [14, 15].

## Data collection

We collected clinical and demographic information by self-report questionnaires at the initial screening visit in the RCT. Quantitative data querying GPE were also collected via self-report questionnaire after 12 weeks of care. Patients were asked, "Overall, how much has your neck pain changed since you started treatment in the study?" Nine response choices were provided: no symptoms (100 % improvement) to twice as bad (100 % worse) [16, 17].

Qualitative data were collected through one-on-one interviews at the end of the 12-week study treatment phase. Interviews were conducted by five individuals trained in a standardized protocol for conducting interviews. A semi-structured schedule of open-ended questions was used to ensure consistency with the study's purpose [18]; (see Table 1). All interviews were tape-recorded and transcribed verbatim. A random sample of 10 % of the transcriptions was compared to the tape-recorded interviews to ensure accuracy.

**Table 1** Interview schedule

Question	Probe questions
When we asked you in the questionnaire, 'how much has your neck pain changed over the course of treatment', what things did you consider when answering that question?	Can you tell me more about that? In what way? How so?
Why do you think your neck pain got better/worse?	Why do you think that is? Can you tell me more?
Do you think it is possible to reach 100 % improvement or complete recovery from your neck pain?	IF NOT...why do you think that is? Can you tell me more about that?

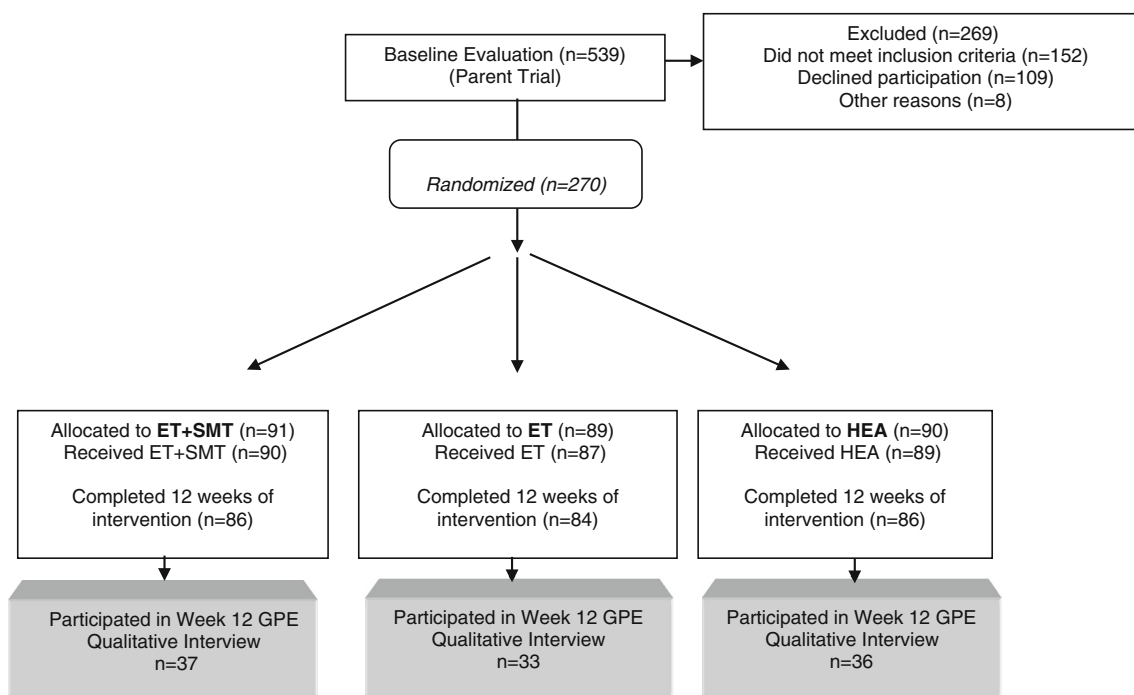
### Data analysis

Descriptive statistics were used to summarize the demographic and clinical characteristics. Two authors (R.E., M.M.) performed a template style content analysis of the interviews [19–22]. First, the transcribed texts were independently reviewed to gain a general understanding of the data and establish preliminary codes [10, 19–21, 23]. Upon review of 20 interviews, they convened to discuss their impressions and develop a working codebook, which guided the coding of interviews into concepts [21]. The development of the codebook was informed primarily by ideas that emerged from interviews (inductive), as well as past studies (deductive) [15].

The remaining transcripts were then analyzed independently, with periodic meetings to revise the codebook as necessary. Representative patient quotations were identified during the coding process. After the independent coding was completed, meetings were held to review discordant cases in an effort to gain consensus. If consensus could not be reached, a third party was available to arbitrate (GB). Similar concepts were then organized and grouped into larger thematic categories. These were then quantified by categorizing themes as present or absent for each case [10]. Theme frequency by treatment group was calculated and described.

### Results

Figure 1 summarizes the flow of study participants from the parent RCT to the qualitative study. Our qualitative sampling resulted in 106 respondents from 253 participants who completed the 12-week follow-up in the RCT with a balanced distribution across treatment groups. Overall, the pre-treatment demographic and clinical characteristics of the qualitative study respondents were similar to the parent RCT participants as were the self-reported outcomes after 12 weeks of care (Table 2). Subjects were predominantly female, middle age, with moderate pain and disability that was long-standing in nature. The qualitative respondents in the ET group were slightly older, and the ET + SMT group had less female membership than in the parent RCT.

**Fig. 1** Flow of participants from parent randomized clinical trial to qualitative study

**Table 2** Demographic and clinical characteristics of participants

	Qualitative study				Parent trial			
	ET + SMT	ET	HEA	Total	ET + SMT	ET	HEA	Total
Number of participants	37	33	36	106	84	84	85	253*
Age (years)	46.2 ± 11.7	52.4 ± 8.9	48.2 ± 10.9	48.8 ± 10.9	44.9 ± 11.5	49.2 ± 9.5	45.9 ± 10.4	46.7 ± 10.6
% Female	64.9	78.8	75.0	72.6	71.4	73.0	72.2	72.2
Duration of neck pain (years)	9.1 ± 9.9	10.8 ± 10.9	10.3 ± 8.9	10.0 ± 9.8	8.9 ± 9.1	10.1 ± 9.7	9.2 ± 8.9	9.4 ± 9.3
Neck pain at baseline (0–10)	5.5 ± 1.5	5.7 ± 1.5	5.6 ± 1.2	5.6 ± 1.4	5.6 ± 1.3	5.6 ± 1.4	5.5 ± 1.3	5.6 ± 1.3
Neck pain at 12 weeks (0–10)	2.4 ± 1.8	2.6 ± 2.2	3.4 ± 2.1	2.8 ± 2.1	2.4 ± 1.8	2.6 ± 1.9	3.6 ± 2.1	2.9 ± 2.0
Neck disability at baseline (0–100)	27.4 ± 9.2	26.5 ± 11.4	27.4 ± 8.1	27.1 ± 9.5	27.4 ± 8.7	26.0 ± 9.8	28.1 ± 8.7	27.2 ± 9.1
Neck disability at 12 weeks (0–100)	13.8 ± 9.3	17.1 ± 11.8	18.6 ± 9.7	16.5 ± 10.4	14.5 ± 9.5	15.9 ± 11.3	19.7 ± 10.5	16.7 ± 10.6
GPE 12 weeks**								
Much improved	21 (57 %)	20 (61 %)	12 (33 %)	53 (50 %)	46 (55 %)	47 (56 %)	27 (32 %)	120 (47 %)
Improved	15 (41 %)	9 (27 %)	15 (42 %)	39 (37 %)	34 (41 %)	28 (33 %)	38 (45 %)	100 (40 %)
Not improved	1 (3 %)	4 (12 %)	9 (25 %)	14 (13 %)	4 (5 %)	9 (11 %)	20 (24 %)	33 (13 %)

\* Represent the participants who completed the 12-week follow-up and provided GPE data (253 of 270 randomized)

\*\* 9-point scale recoded to three categories (Much Improved = no symptoms, much better; Improved = a little better, somewhat better; Not Improved = no change, a little worse, somewhat worse, much worse and twice as bad)

**Table 3** Factors patients considered when determining Global Perceived Effect (by treatment group)

Factors	Number of participants citing factor				Illustrative quotes
	Total (n = 106)	ET + SMT (n = 37)	ET (n = 33)	HEA (n = 36)	
Neck symptoms	90 (85 %)	29 (78 %)	28 (85 %)	33 (92 %)	“The fact that, you know...it seems the bothersome is still there and so I still think it’s... it’s almost the same”
Biomechanical performance	40 (38 %)	14 (38 %)	17 (52 %)	9 (25 %)	“Ah, well, I know it’s changed. I’ve gotten a lot stronger... I can do more things with it. I can turn it better and just in general I just feel stronger...”
Activities of daily living	33 (31 %)	15 (41 %)	10 (30 %)	8 (22 %)	“I still have pain when I’m sitting at the computer for a length of time...or doing that kind of a task...but it doesn’t happen as quickly”
Self-efficacy	11 (10 %)	5 (14 %)	3 (9 %)	3 (8 %)	“I feel that I have a little more control over when I do experience the pain in the neck area... I can do some of the exercises that tend to relieve some of the pain that I get...I just feel that I have a little more control over my circumstance right now”
Other treatment	6 (6 %)	1 (3 %)	4 (12 %)	1 (3 %)	“I’m not taking medication like I was...so, that was kind of my indicator”

Each participant could cite multiple factors

Based on the quantitative GPE self-report questionnaire most individuals experienced some degree of self-reported improvement after 12 weeks of treatment with only a small number (13 %) rating themselves not improved or worse. The two supervised exercise groups reported greater improvement than the HEA group in both the qualitative study and the quantitative RCT (see Table 2) [11].

All interviews were deemed readily interpretable and sufficient for analysis; consensus was reached on all thematic coding. Results of the interview analysis are

described below. Tables 3, 4 and 5 provide frequency of identified themes and representative patient quotes.

What factors do chronic neck pain patients consider when determining their GPE?

We identified five main themes (see Fig. 2; Table 3) respondents took into account when assessing their GPE. The most frequently cited theme was related to individuals’ neck symptoms (85 %, n = 90). This included perceptions

**Table 4** Factors contributing to Global Perceived Effect

Factors	Number of participants citing factor				Illustrative quotes
	Total ( <i>n</i> = 106)	ET + SMT ( <i>n</i> = 37)	ET ( <i>n</i> = 33)	HEA ( <i>n</i> = 36)	
Treatment process	69 (65 %)	25 (68 %)	23 (70 %)	21 (58 %)	“...when I started doing the exercises... the pain that I was having kind of started to diminish until it was, you know, with repetition of doing the exercises for the neck it just kind of, went away”
Biomechanical performance	54 (51 %)	24 (65 %)	17 (52 %)	13 (36 %)	“Without the strength, my posture was slipping back....”
Self-efficacy	17 (16 %)	5 (14 %)	5 (15 %)	7 (19 %)	“I’m able to help myself. I mean, I’m looking at it more like, okay, you can do this yourself, you can make your own pain go away”
Nature of condition	8 (8 %)	2 (5 %)	2 (6 %)	4 (11 %)	“I think it’s just intractable...I don’t think anything’s going to change it...and I have thought about this, maybe because it’s been there so many years that, you know, and I’m not young. I mean, I’m 59 years, I’m almost 60”

Each participant could cite multiple factors

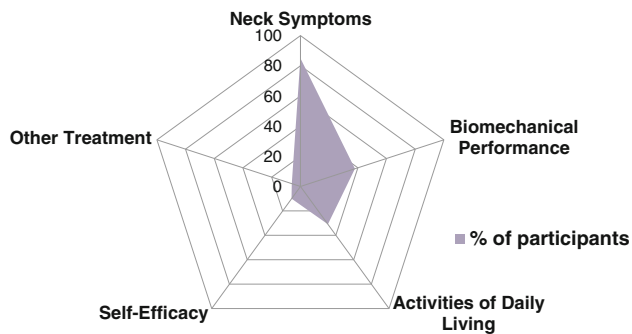
**Table 5** Is complete recovery possible? If no, why not?

	Number of participants				Illustrative quotes
	Total ( <i>n</i> = 106)	ET + SMT ( <i>n</i> = 37)	ET ( <i>n</i> = 33)	HEA ( <i>n</i> = 36)	
Yes	37 (35 %)	12 (32 %)	13 (39 %)	12 (33 %)	Short answer response; no quotations recorded
No	67 (63 %)	25 (68 %)	18 (55 %)	24 (67 %)	
Themes*	Total ( <i>n</i> = 67)	ET + SMT ( <i>n</i> = 25)	ET ( <i>n</i> = 18)	HEA ( <i>n</i> = 24)	
Nature of condition	39 (58 %)	15 (60 %)	12 (67 %)	12 (50 %)	“It’s been going too long. I’ve tried too many different things and some suggestions or diagnosis, if you will...ah, chronic degenerative disc stuff...I don’t know whether or not it can be just reversed at all...”
Activities of daily living	7 (10 %)	4 (16 %)	1 (6 %)	2 (8 %)	“I get in the car and it starts up”
Lack of diagnosis	3 (5 %)	1 (4 %)	1 (6 %)	1 (4 %)	“... is there something more that we don’t know about...because I’ve never been scanned or had an MRI or anything like that to see if there’s anything really in the nerve or something in the, I don’t know, in the spine..Cervical spine. I don’t really know They’ve never wanted to ever scan me. Just said, oh, exercise...”
History of failed treatment	3 (5 %)	1 (4 %)	0 (0 %)	2 (8 %)	“I’m beginning to think not...because I’ve gone through almost all the little avenues from massage therapy to exercise programs...While everything helps a little bit, nothing does anything substantial”

\* Each participant could cite multiple factors

related to their neck condition in general, and the nature of their neck pain specifically, including severity, type and frequency of pain and discomfort. An additional 38 % (*n* = 40), considered the biomechanical performance of their neck. This included awareness of their strength and/or ability to move (e.g., motion). Almost one-third of respondents (31 %, *n* = 33) took into account their

activities of daily living, including ability to work, participate in leisure activities, and sleep. Fewer respondents (10 %, *n* = 11) considered self-efficacy, that is an ability to manage their neck pain condition on their own. Finally, a small number of respondents (6 %, *n* = 6) took into account their need for other treatments. Approximately twice as many individuals in the ET group cited changes in



**Fig. 2** Factors participants considered when determining Global Perceived Effect (illustrated by percentage of citing theme)

biomechanical performance compared to the HEA group. Similarly, a greater number of individuals in ET and SMT cited activities of daily living compared to HEA (Table 4).

What factors do patients believe contributed to a change or lack of change?

There were four main themes to which patients attributed a change or lack of change when assessing their GPE (Table 4). The most commonly mentioned were those related to the treatment process ( $n = 69$ , 65 %), that is those aspects routine to the administration of the intervention. This included whether or not respondents felt aspects typical to the intervention were helpful or not, such as treatment-associated information, physical maneuvers (e.g., specific exercises, manipulation) and format (e.g., supervised versus self-guided). Half of respondents ( $n = 54$ , 51 %) cited changes or lack of changes in their neck-related biomechanical performance (e.g., strength, motion) as playing a role in their improvement. Smaller numbers of respondents attributed improvement to changes in self-efficacy or the extent to which they were able to manage their condition themselves ( $n = 17$ , 16 %). The nature of the condition was cited by smaller numbers of patients ( $n = 8$ , 8 %). This included previous diagnoses, lack of diagnosis, age, and the long-standing nature of their problem.

Individuals from all three treatment groups responded similarly with one thematic exception. More respondents in the ET + SMT group attributed the change or lack of change in their condition to their perceived biomechanical performance.

Do chronic neck pain patients think it is possible to completely improve or recover?

When asked whether they thought it possible to experience complete recovery, approximately one-third (35,  $n = 37$ ) of respondents expressed it was. In contrast 63 % ( $n = 67$ )

expressed they felt it was not possible, or they were unsure. Of those, four main themes were identified in response to the probe question that explored the underlying reasons (see Table 5).

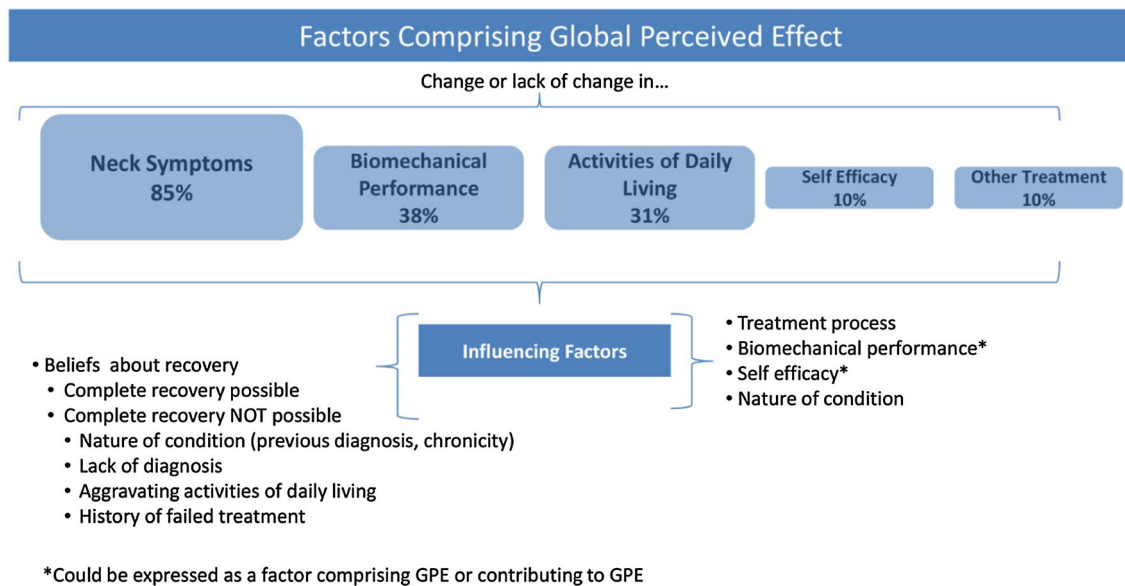
By far, the most common reason given was the perception that the nature of their condition prevented complete recovery (58 %). This included previous diagnosis (e.g., “arthritis”), age, or chronic nature of the condition. Other less frequently cited reasons were daily activities (10 %) which were viewed as aggravating their condition (e.g., their work), lack of diagnosis (5 %), and history of failed treatment (5 %). There were no notable differences between the three treatments regarding likelihood of full recovery, or the reasons provided.

## Discussion

Despite the widespread use of the GPE, its measurement properties for neck and back conditions have been poorly researched. This study is among the first to explore the meaning of GPE in chronic neck pain sufferers. It is unique in that it used a mix of qualitative and quantitative methods to explore the underlying theoretical assumptions related to the GPE. Based on the results, a model of GPE emerges in which GPE captures several distinct domains important to neck pain patients, which may be influenced by a variety of factors (see Fig. 3).

### Meaning of GPE to neck pain patients

One of the underlying assumptions of the GPE is that it measures a composite or summary assessment of multiple domains relative to “improvement” or “recovery” of one’s condition. Our findings suggest that this is the case for neck pain sufferers. We identified five main themes regarding the factors participants took into account when considering their GPE, all which could be viewed as being “outcomes” oriented. Four of these, change in neck complaint, activities of daily living, self-efficacy and need for other treatments, are routinely measured in clinical trials and practice. Perceptions or cognitive assessment of one’s neck biomechanical performance (e.g., how strong it feels, how well it moves) was also commonly expressed; this is notable as this is not a domain typically measured via self-report measures. Thus our findings suggest that the GPE captures patients’ perceptions of global change, in which they consider different factors related to their individual experiences which may or may not be measured by other commonly used self-report instruments. Additionally, the emphasis patients placed on their own cognitive appraisal of biomechanical performance illustrates a gap in existing patient-oriented outcomes instruments; this may in part



**Fig. 3** A model of Global Perceived Effect in chronic neck pain patients

explain existing instruments' lack of responsiveness. Future research should examine the impact of cognitive awareness of strength, motion and movement in chronic neck pain patients, and consider the appropriateness of measuring it on a routine basis through the refinement of existing instruments, or the development of new ones.

Explanatory factors related to GPE and implications for the parent study results

When expressing why they felt their condition had improved or not improved, patients most commonly cited reasons related to the treatment process. This included procedures routine to treatment, including specific maneuvers such as exercises and manipulation, as well as the delivery format (e.g., frequency, dose, supervision, etc.). In the parent RCT, the two supervised exercise groups not only rated themselves as significantly more improved, but also more satisfied with the care they received compared to the home exercise group [11]. This may be related to the extent which the treatments received were congruent with patients' beliefs and expectations of what they needed. While this issue was not examined in this study, a more detailed exploration of patient satisfaction will be addressed in a subsequent publication. However, the emphasis patients placed on treatment process coupled with self-rated quantitative measures of improvement and satisfaction, suggests it is likely that the contextual aspects of treatment contributed to the advantage of the two supervised exercise groups the RCT.

A large number of patients also cited biomechanical factors as explaining why their neck condition improved or

did not improve. In the parent RCT, significant advantages were observed in blinded quantitative measures of strength in the two supervised exercise groups [11]. These qualitative and quantitative findings confirm that biomechanical performance (both true physiological changes and cognitive appraisal or perception of such changes) likely played an important role in the RCT outcomes. The relationship between objectively measured and patient-perceived biomechanical performance requires further study.

Barriers to improvement

The responses to whether or not patients felt they could be 100 % improved or completely recovered highlights potential barriers to improvement with implications for both clinical management and research of chronic neck pain sufferers.

Nearly two-thirds of our sample believed they could not reach complete recovery. Of these, the most frequently cited reason was the perceived intractable nature of their condition which participants attributed to a variety of reasons including a previous diagnosis (e.g., arthritis, degeneration, etc.), advancing age, or the chronic nature of their condition. As stated by one patient: "It's been going too long...chronic degenerative disc stuff...I don't know whether or not it can be just reversed at all." In the absence of clearly defined causal mechanisms for neck and other chronic musculoskeletal pain conditions, we are unable to judge with certainty whether or not patients are right or wrong; however, while the identification of a definitive "cause" may provide relief for some patients [24], the labeling effect imparted by a diagnosis and the notion that

a condition cannot be resolved may also prove problematic. These factors, especially when coupled with long-standing pain, may contribute to a cycle of reinforced expectations in which physiological measures are negatively altered at central pain processing levels further propagating the chronic pain experience [25].

Conversely, the realistic acknowledgement that one cannot completely recover may be a necessary and healthy adaptation to the chronic pain process, with being “better” involving the redefinition of self and accommodation of pain as part of life [26, 27]. It is likely that many patients will require help to reach this phase. Interventions aimed at changing patients’ perceptions of their ability to better manage their pain may be important to pursue, either alone or in conjunction with other promising therapies.

### Strengths and limitations

This mixed-method study provides a more comprehensive understanding of how chronic neck pain patients view GPE than what was previously known. By calculating theme frequency, we have gained an impression of the relative importance of various GPE-related factors and observed that not all factors might be important to all patients. Consequently, the GPE can be viewed as a patient-oriented measure which is capable of measuring domains important to the individual.

The qualitative aspect of this work played a supportive role to the quantitative aspects. While this is a legitimate approach to mixed-methods research [10], it may have impacted our sampling, and consequently our results. Given the similarity in most baseline demographic and clinical characteristics between the parent trial participants and interviewees, as well as participants in other studies (including primary care settings) [28–31], we have confidence in the representative nature of our sample. It is possible, however, that the slightly older nature of the ET group, and greater number of males in the ET + SMT group may have influenced the nature of our qualitative results.

It is also possible that interviewees were influenced by the context of participating in the parent RCT (e.g., receiving specific treatments, going through specific study specific protocols, etc.) [10]. Further, the authors’ previous clinical and research experiences may have influenced the analysis and interpretation. Both of these scenarios could result in different conclusions regarding GPE than what might be observed in other settings. The fact that our observations are similar to previous research in low back pain [8] diminishes this concern.

Some of the identified themes were vocalized by only a small number of participants; this does not mean, however, these cases are unimportant. Rather, these exceptional

cases, which otherwise might be lost in purely quantitative research, illustrate the idiosyncratic nature of the pain experience and the complexity of GPE. Importantly, the fact that the GPE encompasses such diversity, illustrates how it allows individuals to focus on those outcomes most relevant to them.

A limitation of our analysis is the subjective nature of thematic interpretation. Attempts to minimize this included creation of a codebook and meetings between coders to ensure consistency [21]. Further, the open-ended approach of interviewing (versus forcing a response of yes or no for each theme) does not guarantee that all patients expressed all the themes relevant to them; thus some themes might be under-represented. An attempt to minimize this was made by using objective probe questions during interviews, and assessing interviews for internal consistency during analysis.

This study did not address whether or not the GPE is a valid “transition” scale, that is, the extent to which it measures real change of a domain accurately over time [32]. Research in low back and other musculoskeletal conditions has found the GPE to perform poorly in this regard, being strongly affected by patient’s current status, especially as transition time lengthens [32]. Thus, it is important to recognize that the GPE is likely a better measure of patients’ perceptions or cognitive appraisals of change in multiple domains, versus true change in a specific domain such as pain or disability. This has important implications regarding the interpretation of GPE in research and clinical practice, including its use as a potential ‘reference’ or ‘gold standard’ [33]. Further research is needed to assess the impact of GPE on patients’ long-term self-management and care-seeking behaviors that have the most socio-economic impact.

### Conclusions

This work provides a better understanding of the meaning of GPE and influencing factors, than what was previously known. The GPE appears to capture chronic neck pain patient perceptions of change in different domains important to their individual pain experiences which may not be captured by other outcome instruments. Thus, the GPE scales are useful measurement tools for clinical practice and research.

Many chronic neck pain patients believe it impossible to reach complete recovery because of a perceived intractable aspect of their neck condition, often related to previous diagnosis. To optimize patient recovery levels, future neck pain research should examine the interface between patients’ perceptions and pain processing mechanisms, and the extent to which these affect health states and behaviors.



When asked why they felt their condition had or had not improved, participants most commonly cited reasons related to treatment process including specific maneuvers and delivery formats such as frequency, dose, and supervision. This suggests the contextual aspects of treatment play an important role in neck pain patients' views of their recovery. Patients' cognitive assessments of their biomechanical function, including perceptions of strength and mobility also figured prominently in relation to GPE and warrant further measurement and attention in future research.

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**Conflict of interest** None.

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