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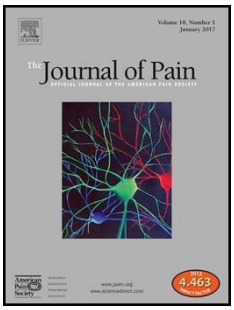

Title: Validity of the Visual Trajectories Questionnaire for Pain (VTQ-Pain)

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PII: S1526-5900(17)30675-2
DOI: http://dx.doi.org/doi: 10.1016/j.jpain.2017.07.011
Reference: YJPAI 3452

To appear in: *The Journal of Pain*

Received date: 10-2-2017
Revised date: 3-7-2017
Accepted date: 17-7-2017

Please cite this article as: Kate M Dunn, Paul Campbell, Kelvin P Jordan, Validity of the Visual Trajectories Questionnaire for Pain (VTQ-Pain), *The Journal of Pain* (2017), http://dx.doi.org/doi: 10.1016/j.jpain.2017.07.011.

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Validity of the Visual Trajectories Questionnaire for pain (VTQ-Pain)

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Number of text pages (including pages containing figures and tables): 16

Number of figures and tables: 6

Funding and disclosures

This work and Prof. Dunn were supported by a Research Career Development Fellowship from the Wellcome Trust [083572]. Prof. Dunn, Dr Campbell and Prof Jordan have no conflicts of interest to disclose. Thanks to the members of the Research User Group (RUG) at the Research Institute for Primary Care & Health Sciences, Keele University.

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Highlights

- There is growing clinical/research interest in longitudinal patient pain trajectories
- We tested the validity of a self-report trajectories question in a back pain population
- We compared self-report trajectories to trajectories derived using monthly measurements
- We report acceptable validity of a new self-report measure of trajectories

Abstract

Researchers have identified trajectories of pain derived using statistical techniques on longitudinal data. These trajectories have potential to be of use clinically but the repeated data collection required is currently impractical for such situations. Our aim was to investigate the validity of a self-report Visual Trajectories Questionnaire-Pain for pain. Analysis included participants from two prospective cohorts of people seeking primary health care for back pain (n=622). A question was developed asking people to classify their pain experience into one of a number of trajectories using visual and word descriptions. Overall 98% of participants completed the question, criterion validity was established by comparing self-report trajectories and trajectories derived using longitudinal latent class analysis, and construct validity was established by comparing responses to the questionnaire against an existing model of back pain stages. As expected variables such as pain intensity and widespreadness, other symptoms and psychological distress showed an increasing trend of severity across trajectory categories in line with the hypothesised model. In conclusion, the self-report single item Visual Trajectories Questionnaire is acceptable to patients and supported by evidence of face, criterion and construct validity. Further research is needed to investigate the clinical usefulness of the question.

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Perspective

This study provides a new questionnaire (Visual Trajectories Questionnaire) that captures the longitudinal state of a patient's pain experience. The Visual Trajectories Questionnaire has demonstrated aspects of face, criterion and construct validity, and has the potential to be clinically useful.

Keywords: Pain, Measurement, Trajectories, Questionnaire, Validity

Background

Over the last few years, a number of studies have identified trajectories of back pain.[1,7,14,17,22] These studies have provided new insights into the course of pain, and indicate that people with back pain can be classified into discrete trajectories with distinct characteristics which have potential clinical usefulness.[2,13] However, the studies have all used repeated measures collected during prospective longitudinal studies, often with complex analytical techniques, to identify the trajectories and classify the patients. These methods are time-consuming and not always feasible, and mean that the trajectories currently have limited clinical usefulness, as few clinical situations allow for the collection of longitudinal data to categorise patients.

One solution is to ask patients themselves which trajectory best represents the course of their back pain, and this has been suggested in a recent review of research on back pain trajectories.[13] Such a question would then allow researchers and clinicians to allocate people with back pain into trajectory groups without having to collect large amounts of data. However, it is not known whether patients can identify their own trajectory, and whether their responses are valid.

There are a number of stages needed to test the validity of such a question. The first element of this is face validity; whether patients can understand the question and

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assign themselves to a trajectory.[3] The second component is criterion validity; how well a question compares with an independent external objective criterion or gold standard.[3,18] For pain trajectories, the external criterion would be the empirical trajectories derived using longitudinal data. The third part would be construct validity, or the extent to which a measure is related to criteria derived from an established theory.[3,18] One model of pain against which it is useful to make this comparison is the stages of pain model.[20] This model not only understands chronicity by the temporal experience of pain over time but also incorporates a multidimensional consideration of other types of pain, various bodily complaints and cognitive and emotional impairments. Evidence shows these conditions are common in those with back pain, are linked to severity, and play a significant role in prognosis.[11] Testing construct validity using this model would mean investigating whether 'worsening' trajectories of pain show parallels with different stages of pain and their associated characteristics.

The aim of this study was therefore to investigate the validity of a self-report question (called the Visual Trajectories Questionnaire-Pain, or VTQ-Pain) asking patients to identify the trajectory that best represents their pain experience.

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Methods

This study was nested in two cohorts of people seeking primary health care for their back pain (BaRNS Study and BeBack Study). Study participants were consecutive patients visiting their GP about back pain during 2001-2 (BaRNS) or 2004-6 (BeBack); all were invited to take part in a prospective cohort study using questionnaires and followed for up to a year. Further details are published elsewhere.[6,7,9] The cohorts were followed up again 7 years (BaRNS) or 5 years

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(BeBack) later (called the second study period in this paper).[4,5] The second study period consisted of a baseline questionnaire, short monthly questionnaires, and a final questionnaire at 12-months. All phases of both studies were independently approved by the North Staffordshire, South Staffordshire and North West Cheshire Research Ethics Committees.

A draft question asking patients to classify their back pain experience into a trajectory was developed based on trajectories previously derived through statistical modelling. Four trajectories were developed directly from typical individual trajectories identified within previously published work based on regular reporting of back pain intensity.[7] The trajectories reported (from 342 consulters) were; persistent mild (n = 122) who had stable low levels of persistent mild pain, recovering (n = 104) who had mild pain to no pain, severe chronic (n = 71) who had permanent high levels of pain, and fluctuating (n = 45) who had pain that moved between mild and high pain over the time period. Three further trajectories were developed using more general information about the course of back pain such as pain that has gradually got worse, having a single episode, and pain that has gradually got better[16] These seven trajectories were thought to capture the range of experience of pain through time and be appropriate for studies where participants are known to have had a back pain episode within the recall period. An additional item representing no pain was developed for studies where the participants may not have had pain during the recall period. The final question comprised eight pictures of the individual trajectories of pain, with corresponding brief descriptions of each trajectory. The question will be referred to as the Visual Trajectories Questionnaire-Pain (VTQ-Pain) and was assessed at the 12 month follow-up point of the second study period.

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Initial assessments of acceptability and components of face validity were carried out with a small group of patients with experience of musculoskeletal pain - the Research User Group (RUG) at the Research Institute for Primary Care & Health Sciences, Keele University. The RUG has approximately 100 members and many have conditions such as back pain, osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, mental health conditions, and long term health conditions. The age range is from 33 years to 87 years, and there is an even representation from both males and females. RUG members are involved in most aspects of the research process and take part in advisory groups, steering groups, research meetings, co-applicants, and implementation meetings. The group involved in the VTQ-Pain development consisted of 8 members, all with musculoskeletal problems (approximately half with back pain). These RUG members were sent the Visual Trajectories Questionnaire-Pain in advance and then invited to a meeting, and asked whether they understood the question, and whether they could suggest any improvements.

Following amendments based on RUG feedback (see results section), the Visual Trajectories Questionnaire-Pain was included in the baseline and 12-month second study period questionnaires for the BaRNS and BeBack Study cohorts. The 7 item version was included in the baseline questionnaire, referring to the period since the start of the study (7 years or 5 years previously); the 8 item version (including the no pain trajectory as used in this current analysis) was included in the 12-month follow-up questionnaires referring to the previous year. Components of face validity were tested by the views of the RUG feedback, as detailed above, and also determining the proportion of patients who were able to answer the question in the baseline second study period questionnaires using response/completion rates as an indicator.

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Criterion validity was explored by comparing self-report trajectory responses in the 12-month follow-up questionnaire with statistically derived trajectories. These trajectories were derived using longitudinal latent class analysis (LLCA) in both cohorts, using the first 6 months of data from the second study period phase. Monthly reported back pain intensity scores were used to derive trajectories using LLCA, each participant was allocated to a trajectory based on their largest probability. Briefly pain intensity was measured on a monthly basis using the mean of three 0– 10 numerical rating scales. These values were trichotomised into no pain (scoring less than 1), mild-moderate pain, and high pain (score of 5 or more) for each month. LLCA was then used to group participants into clusters based on these pain measurements over 6 months. Derived posterior probabilities indicated the probability of a participant belonging to each cluster, and participants were allocated to the cluster for which they had the largest probability of belonging, i.e. best match to their pain profile. Cluster-specific probabilities of having each level of pain for each month, given membership of that cluster, allowed descriptions of the pain pathways for each cluster. The derived clusters have been demonstrated to give a good fit to the observed patterns.[5] Full details of how the statistically derived trajectories were developed have been published.[5] Previous work has shown that trajectory membership is stable over a 1-year period,[7] and even longer,[5] so using derived trajectories from the first 6 months of the recalled period is appropriate. Relationships between the Visual Trajectories Questionnaire-Pain at 12 month follow-up and the statistically derived trajectories were hypothesised as in Table 1.

Insert Table 1 about here

Construct validity was tested by comparing responses to the Visual Trajectories Questionnaire-Pain in the baseline questionnaire of the second study period against

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constructs supported by the stages of pain model (also assessed at baseline).[20] In summary, the model proposes Stage 0: pain in the back; Stage 1: pain radiating elsewhere (below the knee and other parts of the body); Stage 2: amplification beyond pain (e.g. reduced vitality and occurrence of other symptoms); Stage 3: amplification to psychological distress (the occurrence of catastrophising and/or depression/anxiety), with each stage also displaying the symptoms of the previous stage. Applying this to the Visual Trajectories Questionnaire-Pain responses, we would expect that people self-reporting trajectories with no pain most of the time would be closest to Stage 0, those with trajectories indicating repeated pain episodes but no pain a lot of the time would have characteristics of Stage 1, those with constant mild pain would be closest to Stage 2 and those with constant severe or fluctuating pain would be closest to Stage 3.

Pain in the back was represented by pain intensity at baseline using the mean of three 0-10 numerical rating scales.[8] Pain radiating elsewhere was measured as the proportion of patients with pain spreading below the knee, and the proportion with pain elsewhere in the body (shoulder, arm, neck or head). Amplification beyond pain was measured using the vitality subscale of the SF-12 (BaRNS Study only),[23] somatic symptoms from the 15-item Patient Health Questionnaire (PHQ-15 – scored from 0 (not bothered with any symptoms) to 30 (bothered a lot with all 15 symptoms),[15] insomnia (proportion reporting having trouble falling or staying asleep, waking up several times at night or waking up feeling tired on most nights),[12] and disability (Roland-Morris Disability Questionnaire).[19,21] Amplification to psychological distress was measured using a measure of catastrophizing (full 5 item catastrophising subscale of the Coping Strategies Questionnaire 24 for the BaRNS study,[10] and a single item dichotomous catastrophising item from the same scale in

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the BeBack study), and the anxiety and depressive symptoms subscales of the Hospital Anxiety & Depression Scale (HADS – scored from 0 to 21, with higher scores indicating more severe symptoms).[24] We determined using linear/logistic regression the amount of variance explained (e.g. R^2) by the Visual Trajectories Questionnaire-Pain and by the LLCA trajectories for each of the construct validity variables.

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Results

The patients in the RUG group reported that the Visual Trajectories Questionnaire-Pain was easy to understand, they did not report any difficulty in understanding the axes, there was no mention of additional trajectories, and they would be able to complete it. They suggested a minor amendment to the formatting of the trajectory pictures that they felt would make them more easily understood (original version had the area under the line shaded, the RUG asked for this to be removed). The final Visual Trajectories Questionnaire-Pain is presented in Figure 1.

Insert Figure 1 about here

Face validity

In the second study period baseline questionnaires, 98% of respondents were able to answer and complete the Visual Trajectories Questionnaire-Pain (202/208 in BaRNS and 420/429 in BeBack). Similar response frequencies were found in the 12-month follow-up. Frequencies of response to the individual trajectories at baseline are shown in Table 2. These indicate that the proportion of people selecting each trajectory is very similar between the two cohorts. The most common trajectory

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selected (40%) indicated that a large proportion of responders experienced “A few episodes of back pain, with mostly pain-free periods in between”. The next most common trajectory (24% of responders) was “Some back pain most of the time, and a few episodes of severe pain”.

Insert Table 2 about here

Criterion validity

The self-reported visual trajectory responses given in the 12-month questionnaire from the second study period of the studies are compared with trajectories derived using LLCA for the two cohorts (*n*=373) in Table 3. These indicate that the observed relationships between self-reported Visual Trajectories Questionnaire-Pain responses and the derived trajectories are broadly in line with the hypothesised relationships (Table 1). For example, 73% of those reporting a visual trajectory of “A single episode with no other major episodes of back pain”, and 86% of those reporting “No back pain, or only the odd day with mild pain” were observed to have a statistically derived trajectory of no or occasional mild pain. Similarly, 77% of those reporting “Severe back pain all or nearly all of the time” had a statistically derived trajectory of persistent severe pain. However, there were some differences between hypothesised and observed relationships; for example, only 36% of those reporting “A few episodes of back pain, with mostly pain-free periods in between” were classified as having no or occasional pain within the LLCA trajectories, with the majority (56%) classified within the persistent mild pain LLCA trajectory. This may have been driven by increased frequency (episodes) and in this case persistent may also include some with pain free episodes which are less frequent. Comparison of the “Some back pain most of the time, and a few episodes of severe pain” with the

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"Pain that goes up and down all the time, with episodes of severe pain" categories shows the former have the majority (62%) of respondents classified within the persistent mild pain LLCA trajectory, whereas the latter had a majority (62%) within the persistent severe pain LLCA trajectory. With regards to the 2 categories which had no direct LLCA trajectory equivalent, those who described themselves as "Back pain that has got gradually worse" show a spread of representation across the LLCA trajectories, with the majority (44%) in the persistent severe pain trajectory, and those who describe themselves as "Back pain that has improved gradually" are mainly concentrated in the persistent mild pain LLCA trajectory.

Insert Table 3 about here

Construct validity

All variables showed an increasing trend of severity across trajectory categories from (a) (single episode) to (e) (persistent severe back pain), meaning that patients with less frequent and less severe pain have better health than patients with more frequent and severe pain (See Tables 4a and 4b). This is consistent with the stages of pain model. The VTQ-Pain trajectories with no pain most of the time (categories a and b) are closest to Stage 0, displaying no or mild pain (mean pain intensity less than 2) and less than 10% overall reporting radiating pain in the leg. People with constant mild pain (category c) appear to have characteristics of Stage 1, with up to 40% reporting pain radiating down the leg and around 80% reporting pain elsewhere in the body. Respondents with fluctuating pain (category d) have higher levels of somatic symptoms and insomnia than the respondents with milder trajectories, indicating Stage 2, and people with persistent severe pain (category e) have the highest levels of depression, indicating Stage 3. Category (f) (worsening pain)

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showed characteristics similar to Stage 3, and category (g) (improving pain) showed characteristics similar to Stage 0. There was a generally similar level of variance explained by the Visual Trajectories Questionnaire-Pain response and by the LLCA trajectories, for each of the construct validity variables, although the LLCA trajectories explained more of the variance for depression. (see Table 5).

Insert Tables 4a and 4b and Table 5 about here

Discussion

We have demonstrated that a new single item Visual Trajectories Questionnaire-Pain, which asks people to categorise themselves into trajectories of pain, is supported by evidence of face, criterion and construct validity in two independent cohorts of primary care back pain consulters. The question is acceptable to patients, and people selecting different response categories are also different in other ways including their statistically derived trajectories of pain, pain radiation and spread, and amplification to other symptoms and psychological distress.

There is support for concordance between the reported trajectories and the LLCA clusters. The majority of respondents who describe their trajectory as having no back pain, improving back pain, or only having a single episode fell within the no or occasional mild pain LLCA trajectory (and none were found in the fluctuating or severe pain LLCA trajectories), whereas those who chose severe pain all the time, pain that goes up and down with severe episodes, or back pain that has got gradually worse, were predominantly in the persistent severe pain LLCA trajectory. An assignment of variables broadly in line with the stages of pain model was demonstrated, but there was not always a clear distinction between the stages and

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"grey" areas will exist using such categorisations. For example, there were gradually increasing mean levels of anxiety as the visual trajectory severity increased, rather than a sudden leap of scores from the other trajectories to the trajectory representing severe pain all or nearly all of the time. Evidence from previous work also shows that rather than a set of stages through which people progress over time,[5] the categories are more likely to reflect different groups of people who remain with similar characteristics over time, i.e. more like phenotypes than transitional phases with overlap between these phenotypes.

Strengths and limitations

This study has the strength of testing the Visual Trajectories Questionnaire in two independent cohorts of primary care back pain consulters. However, due to the nature of identification and retention of participants included here, we cannot give estimates of the prevalence of the visual trajectories. There may be different proportions of people identifying with the response categories in different studies and settings, and this remains to be tested. Testing criterion validity against the reference standard of statistically derived trajectories is a strength. However agreement between self-report and statistically derived trajectories was limited, possibly reflecting bias in recall of trajectories, when compared with trajectories derived using longitudinal data. There were also limited numbers for the analysis with LLCA derived trajectories, and while previous work has demonstrated that people providing data for longitudinal analyses are broadly similar to the whole sample,[5] the possibility for bias remains. Another strength is the wide range of variables included in the testing of construct validity for this question, within two different datasets, and all showed validity (patterns in the expected directions) against the existing construct (stages of pain model) as well as similarity in extent of variance explained by the

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LLCA and self-report trajectories. This study also has a number of limitations. Whilst this study carried out a review of the measure's acceptability/readability by the Research User Group and the response rate of measure completion in the two cohorts was 98%, suggesting the question was acceptable and relevant to responders, there was no inclusion of a "read aloud" session with the RUG or participants to assess the cognitive process of interpretation of the question. In addition there was no option for respondents who did not recognise any of the patterns (e.g. I do not recognise any of the patterns of pain over time), therefore the study may have missed some information to improve or refine the measure and more rigorous testing of face validity is required. Reliability of the measure was not assessed (test-retest). It is also possible that using a shorter recall time (e.g. over the previous month) would give a better comparison to LLCA trajectory clusters than recall over 12 months. Further work is needed to establish the optimum and non-optimum range of recall period that the VTQ-Pain can be used.

LLCA did not identify systematically increasing or decreasing trajectories of change. Only 6% of the population self-reported such patterns (group f - back pain that has got gradually worse, group g - back pain that has improved gradually). This may be a reflection of this population (people with long term back pain). Inspection of the baseline levels of pain intensity for these groups show high pain levels for group f (> 7) and low levels for group g (< 2) and this may reflect the relative stability of pain within this cohort (two long term back pain cohorts) with little room to reflect change in the 12 month period. It may be that the relative frequency of the trajectory groups, including those that capture change over time, may well be different for different populations (for example, if measuring from time of first consultation for back pain). Kongsted et al,[25] recently reported on an inception cohort of consulters (i.e. first time

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of consultation for low back pain) with LLCA trajectories derived from weekly measurements over a 12 month period. They report, using multiple models, 5 to 8 subgroups, with only a small percentage grouped as changing (improvement, worsening, fluctuating) whereas the majority (> 60%) were in stable clusters. This highlights the stability of trajectories, even in a population where more change would be expected and this current study showed participants reporting visual trajectory patterns a) to e) or h), 63.4% had an expected LLCA trajectory. Furthermore whilst there is broad agreement between the participants' chosen trajectory and the LLCA clusters it is not absolute and variation will exist in the interpretation of the trajectories for each person, for example people who have chosen the same trajectory may have chosen differently if asked prospectively, or asked at repeated points over time. The VTQ-Pain has only been tested in those who have reported back pain (the majority of which would have low back pain) and there may be different responses given for different pain conditions, however the measurement of trajectories in this current study is based on pain intensity which can be considered a universal measure across varied pain conditions.

Clinical relevance

This question has potential clinical usefulness, as it is simple for patients to answer, and provides relevant information about other characteristics of the patient. In addition it allows the measurement of trajectories over time without the need to collect data longitudinally. While there are, as yet, no treatments designed to be matched to different pain trajectories, the characteristics of the patients in the different trajectories do present potential targets for intervention. For example, patients who are mostly pain free may benefit from simple advice and reassurance, whereas patients with mild pain most of the time may require more management of

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pain elsewhere and other symptoms, and people with constant higher levels of pain may require interventions targeting psychological aspects of their health as well as their pain and other symptoms. Future research may provide more information about which treatments could be best matched to patients in the different trajectory groups. Furthermore the visual trajectories question may have the potential to be used as an outcome measure, for example to illustrate change in course after an intervention, however further research would be needed to test such a measure within this context (e.g. testing of responsiveness).

In summary, we have developed an acceptable single item question on visual trajectories of pain, with evidence of validity, and potential usefulness in research and clinical practice.

Acknowledgements

This work and Prof. Dunn were supported by a Research Career Development Fellowship from the Wellcome Trust [083572]. Dr Campbell and Prof Jordan have no conflicts of interest to disclose. Thanks to the members of the Research User Group (RUG) at the Research Institute for Primary Care & Health Sciences, Keele University.

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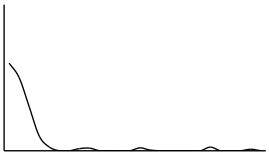
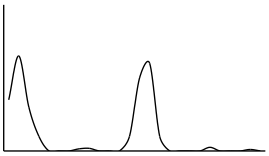
Figure 1. Visual Trajectories Questionnaire-Pain

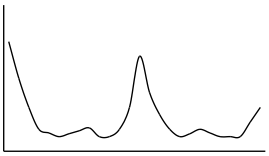
Below are some descriptions of how some people's **back pain can change over time**, with pictures to show how their pain might go up or down. Please look at these and cross the box next to the one option that you think comes closest to how your pain has been over **the last year**[1].

a) 

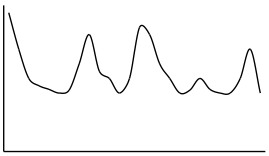
A single episode with no other major episodes of back pain ☐

b) 

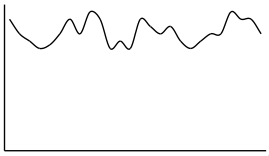
A few episodes of back pain, with mostly pain-free periods in between ☐

c) 

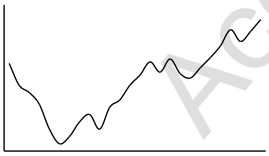
Some back pain most of the time, and a few episodes of severe pain ☐

d) 

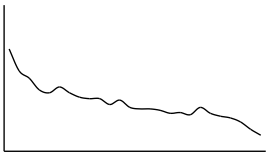
Pain that goes up and down all the time, with episodes of severe back pain ☐

e) 

Severe back pain all or nearly all of the time ☐

f) 

Back pain that has got gradually worse ☐

g) 

Back pain that has improved gradually ☐

h)

No back pain, or only the odd day with mild pain ☐

[1] Timescale should be amended as appropriate.

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Table 1 – Hypothesised relationship between Visual Trajectories Questionnaire-Pain responses at 12 month follow-up and LLCA derived trajectories

	Visual trajectory	Hypothesised LLCA cluster
a)	A single episode with no other major episodes of back pain	No or occasional mild pain
b)	A few episodes of back pain, with mostly pain-free periods in between	No or occasional mild pain
c)	Some back pain most of the time, and a few episodes of severe pain	Persistent mild or fluctuating
d)	Pain that goes up and down all the time, with episodes of severe back pain	Fluctuating or persistent severe
e)	Severe back pain all or nearly all of the time	Persistent severe
f)	Back pain that has got gradually worse	*Unclear**
g)	Back pain that has improved gradually	*Unclear**
h)	No back pain, or only the odd day with mild pain	No or occasional mild pain

* No specific matches were hypothesised with trajectories f and g
LLCA: longitudinal latent class analysis

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Table 2: Response to the Visual Trajectories Questionnaire-Pain in the long-term follow-up baseline questionnaires

		BaRNS Study		BeBack Study		Total	
		Number	Percent	Number	Percent	Number	Percent
a)	A single episode with no other major episodes of back pain	14	6.9%	33	7.9%	47	7.6%
b)	A few episodes of back pain, with mostly pain-free periods in between	79	39.1%	172	41.0%	251	40.4%
c)	Some back pain most of the time, and a few episodes of severe pain	47	23.3%	102	24.3%	149	24.0%
d)	Pain that goes up and down all the time, with episodes of severe back pain	28	13.9%	69	16.4%	97	15.6%
e)	Severe back pain all or nearly all of the time	8	4.0%	15	3.6%	23	3.7%
f)	Back pain that has got gradually worse	12	5.9%	17	4.0%	29	4.7%
g)	Back pain that has improved gradually	14	6.9%	12	2.9%	26	4.2%
	Total	202		420		622	

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Table 3: Comparison of the Visual Trajectories Questionnaire-Pain responses at long-term 12 month follow-up with the four trajectories derived from LLCA (BaRNS and BeBack combined)

		(i) no or occasional mild pain	(ii) persistent mild pain	(iii) fluctuating	(iv) persistent severe pain	Total
a)	A single episode with no other major episodes of back pain	8 (73%)	3 (27%)	0 (0%)	0 (0%)	11
b)	A few episodes of back pain, with mostly pain-free periods in between	42 (36%)	66 (56%)	5 (4%)	4 (3%)	117
c)	Some back pain most of the time, and a few episodes of severe pain	3 (4%)	51 (62%)	13 (16%)	15 (18%)	82
d)	Pain that goes up and down all the time, with episodes of severe back pain	0 (0%)	21 (31%)	5 (7%)	42 (62%)	68
e)	Severe back pain all or nearly all of the time	0 (0%)	3 (23%)	0 (0%)	10 (77%)	13
f)	Back pain that has got gradually worse	2 (22%)	3 (33%)	0 (0%)	4 (44%)	9
g)	Back pain that has improved gradually	2 (14%)	12 (86%)	0 (0%)	0 (0%)	14
h)	No back pain, or only the odd day with mild pain	51 (86%)	8 (14%)	0 (0%)	0 (0%)	59
	Total	108	167	23	75	373

LLCA: longitudinal latent class analysis

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Table 4a: Construct validity – Visual Trajectories Questionnaire-Pain responses against constructs derived from the stages of pain model – BaRNS 7 year follow-up baseline data

		Back pain intensity	Pain radiates to below the knee	Pain else-where	Vitality	Symptoms	Insom nia	Disability	Catastro-phising	Depression	Anxiety
a)	A single episode with no other major episodes of back pain	0.19 (-0.03, 0.41)	0%	14%	3.57 (3.08, 4.06)	2.79 (1.06, 4.51)	46%	0.29 (-0.19, 0.76)	1.13 (-0.57, 2.82)	2.36 (0.99, 3.73)	4.36 (2.79, 5.95)
b)	A few episodes of back pain, with mostly pain-free periods in between	1.17 (0.89, 1.45)	14%	64%	3.27 (3.07, 3.46)	3.94 (3.24, 4.63)	31%	2.16 (1.61, 2.72)	0.74 (0.44, 1.04)	3.46 (2.6, 4.32)	5.46 (4.58, 6.34)
c)	Some back pain most of the time, and a few episodes of severe pain	3.57 (3.01, 4.13)	40%	81%	2.68 (2.43, 2.93)	6.09 (4.85, 7.34)	57%	7.00 (5.46, 8.54)	1.58 (0.96, 2.2)	6.00 (4.87, 7.13)	8.00 (6.81, 9.19)
d)	Pain that goes up and down all the time, with episodes of severe back pain	5.62 (4.73, 6.51)	36%	89%	2.50 (2.14, 2.86)	8.04 (6.37, 9.71)	64%	11.32 (9.34, 13.3)	2.96 (2.19, 3.73)	6.71 (5.3, 8.13)	8.14 (6.88, 9.41)
e)	Severe back pain all or nearly all of the time	6.57 (4.09, 9.06)	86%	86%	1.75 (1.16, 2.34)	8.14 (3.63, 12.66)	75%	14.63 (8.20, 21.05)	4.00 (2.21, 5.79)	7.75 (3.54, 11.96)	9.63 (4.51, 14.74)
f)	Back pain that has got gradually worse	7.30 (5.40, 9.20)	64%	90%	1.73 (1.12, 2.33)	9.30 (3.23, 15.37)	92%	12.83 (8.16, 17.51)	4.56 (3.16, 5.95)	7.83 (5.38, 10.28)	10.17 (7.72, 12.62)

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g)	Back pain that has improved gradually	1.07 (0.15, 2.00)	36%	71%	3.50 (2.83, 4.17)	3.43 (1.42, 5.44)	14%	2.57 (-0.39, 5.53)	1.75 (0.09, 3.41)	3.29 (1.24, 5.33)	3.86 (2.02, 5.69)

Data are mean with 95% CI or proportion. For all variables, increasing values indicate increasing severity, except for vitality in which the opposite is true.

Table 4b: Construct validity – Visual Trajectories Questionnaire-Pain responses against constructs derived from the stages of pain model – BeBack 5 year follow-up baseline data

		Back pain intensity	Pain radiates to below the knee	Pain else-where	Symptoms	Sleep problems	Disability	Catastro-phising	Depression	Anxiety
a)	A single episode with no other major episodes of back pain	0.12 (0.03, 0.23)	12%	27%	3.68 (2.68, 4.74)	19%	0.33 (0.07, 0.59)	0%	3.15 (2.27, 4.06)	5.50 (4.06, 6.94)
b)	A few episodes of back pain, with mostly pain-free periods in between	1.33 (1.07, 1.58)	22%	56%	5.69 (4.86, 6.54)	36%	2.83 (2.23, 3.42)	1%	3.94 (3.44, 4.47)	6.71 (6.05, 7.36)
c)	Some back pain most of the time, and a few episodes of severe pain	3.37 (3.00, 3.72)	29%	81%	9.00 (7.64, 10.43)	55%	6.01 (4.99, 7.03)	17%	4.92 (4.23, 5.55)	7.75 (6.85, 8.64)
d)	Pain that goes up and down all the time, with episodes of severe back pain	4.86 (4.36, 5.38)	48%	80%	10.22 (8.81, 11.70)	80%	11.33 (9.96, 12.70)	36%	7.06 (6.15, 8.09)	8.56 (7.52, 9.60)

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e)	Severe back pain all or nearly all of the time	7.64 (6.84, 8.40)	73%	80%	12.83 (7.34, 18.33)	79%	16.27 (14.84, 17.69)	73%	8.00 (5.86, 10.07)	10.62 (7.81, 13.42)
f)	Back pain that has got gradually worse	6.10 (5.08, 7.00)	41%	82%	8.90 (6.10, 11.70)	59%	10.94 (7.38, 14.50)	47%	7.18 (5.12, 9.53)	9.24 (7.09, 11.38)
g)	Back pain that has improved gradually	1.17 (0.61, 1.80)	25%	50%	5.50 (1.50, 9.50)	17%	2.75 (0.53, 4.97)	0%	2.50 (1.33, 3.67)	5.08 (3.28, 6.89)

Data are mean with 95% CI or proportion. For all variables, increasing values indicate increasing severity.

Table 5

Comparison of Visual Trajectories Questionnaire-Pain and LLCA for construct variable variance (R^2)

Constructs	BaRNS 7 year follow-up baseline data		BeBack 5 year follow-up baseline data	
	LLCA R^2	VTQ-Pain R^2	LLCA R^2	VTQ-Pain R^2
Pain Intensity	0.243	0.192	0.202	0.195
Pain radiates to below the knee*	0.216	0.265	0.195	0.165
Pain elsewhere*	0.185	0.239	0.201	0.159
Vitality*	0.202	0.350	-	-
Symptoms	0.091	0.117	0.103	0.111
Insomnia/sleep problems*	0.255	0.208	0.255	0.198
Disability	0.158	0.164	0.207	0.145
Catastrophising*	0.187	0.148	0.154	0.182
Anxiety*	0.184	0.220	0.066	0.067
Depression*	0.279	0.070	0.306	0.168
* Nagelkerke values				

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