NHS Patient Survey Programme

2018 children and young people's patient experience survey

Technical details for analysing trust-level results

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Contents

1. Introduction

This document outlines the methods used by the Care Quality Commission (CQC) to score and analyse the trust-level results for the 2018 Children and Young People's Patient Experience Survey.

The survey sought feedback directly from children and young people, alongside their parent or carer.

Respondents were sent one of three questionnaires. **Questionnaire A**, sent to children aged between 0 and 7, was completed solely by the parent or carer. **Questionnaire B** and **Questionnaire C**—sent to children aged between 8-11 and 12-15, respectively—were comprised of two parts: a section for the child or young person to complete, and a section for their parent or carer to fill in. Questionnaires B and C had minor design and question differences, tailored to respondent age.

We asked parents and carers of 0 to 7-year-olds some questions that were not included in the 8 to 15 versions of the questionnaires.

Survey data is therefore available for the three groups:
- Children and young people aged between 8 and 15 years[1]
- Parents or carers of 0 to 15–year-olds
- Parents or carers of 0 to 7-year-olds

The survey results are available for each trust on the CQC website. The survey data is shown in a simplified way, identifying whether a trust performed 'better' or 'worse' or 'about the same' as the majority of other trusts for each question. This analysis is based on a statistic called the **'expected range'** (see section 5.3). On publication of the survey, an A-to-Z list of trust names will be available at the link below, containing further links to the survey data for all NHS trusts that took part in the survey: **http://www.cqc.org.uk/childrenssurvey**.

The CQC webpage also contains a statistical release document containing England-level results, alongside relevant national policy and comparisons with the results from the 2016 survey. Further information on the survey is available in the Quality and Methodology report.

A benchmark report is also available for each trust and is published on the Survey Coordination Centre website at: **https://nhssurveys.org/all-files/01-children-patient-experience/05-benchmarks-reports/2018/**

Benchmark reports contain graphical representations of the results displayed for the public on the CQC website, as well as tables that report demographic information, respondent numbers for each question and highlight any statistically significant changes in trust scores between 2016 and 2018.

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[1] One question (X48) was only answered by children aged 8 to 11 and two questions (X49 & X61) were only answered by young people aged 12 to 15.

2. Selecting data for reporting

Scores are assigned to responses to questions that are of an evaluative nature: in other words, those questions that can be used to assess the performance of a trust (see section 5.1 for more detail). Non-evaluative questions tend to be those included solely for 'routing' respondents past any questions that may not be relevant to them (such as X63 "During your time in hospital, did you have any operations or procedures?") or those used for descriptive or information purposes (such as question X75 "Including this visit, how many times has your child been to hospital in the past six months?").

The scores for each question are grouped on the website, and in the benchmark reports for each trust, with respect to questionnaire sections. For example, the children's and young people's parts of the questionnaire for the 2018 survey included sections on "the hospital ward", "operations and procedures" and "leaving hospital".

Alongside both the question and section scores on the website are one of three statements:

- Better
- About the same
- Worse.

This analysis is based on a statistic called the **expected range** (see **section 5.3**)

3. The CQC organisation search tool

The organisation search tool contains information from various areas within the Care Quality Commission's functions. The presentation of the survey data was designed using feedback from people who use the data. As well as meeting data user needs, it presents the groupings of the trust results in a simple and fair way, showing where we are more confident that a trust's score is 'better' or 'worse' than we'd expect, when compared with most other trusts.

The survey data can be accessed through the A to Z link available at **http://www.cqc.org.uk/childrenssurvey** or by searching for a provider on the **CQC home page** and then clicking on "Surveys"**.**

4. The trust benchmark reports

Benchmark reports should be used by NHS trusts to identify how they performed in comparison to most other trusts that took part in the survey. Tables at the end of the report show if a score has significantly increased or decreased compared with the last children and young people's survey in 2016. From this information, areas for improvement can be identified. The reports are available from the Survey Coordination Centre website: **https://nhssurveys.org/surveys/survey/01-children-patient-experience/.**

The graphs included in the reports display the trust's scores, compared with the full range of results from all other trusts that took part in the survey. A separate graph is present for each scored question. The black diamond represents the trust's score on the question, for this year's survey. The bar represents the range of results for the question across all trusts that took part in the survey. The bar is divided into three sections:

- If a trust score lies in the grey section of the graph, the trust's score is 'about the same' as most other trusts in the survey.
- If a trust scores lies in the orange section of the graph, the trust score is 'worse' than expected when compared with most other trusts in the survey.
- If a score lies in the green section of the graph, the trust score is 'better' than expected when compared with most other trusts in the survey.

Note that, because the uncertainty around the result is too great, the black diamond (the trust's score) is not shown for questions answered by fewer than 30 respondents.

5. Interpreting the data

5.1 Scoring

Questions are scored on a scale from 0 to 10. Details of the scoring for this survey are available in **Appendix A** at the end of this document.

The scores represent the extent to which the patient's experience could be improved. Responses that reflect the most negative patient experience are assigned a score of 0 and responses that reflect the most positive patient experience are assigned a score of 10.

Where response options lie between the most negative and most positive responses, scores are assigned at equal intervals along the scale. Where options are provided that do not reflect on the trust's performance, responses are classified as not applicable and a score is not given. Similarly, a score is not given where respondents state that they could not remember or did not know the answer to a question.

5.2 Standardisation

Results are based on 'standardised' data. We know that the views of a respondent can reflect not only their experiences of NHS services, but can also relate to certain demographic characteristics, such as age. The mix of patients varies across trusts, and this could lead to bias, resulting in a trust appearing better or worse than they would if they had a slightly different profile of patients. To account for this, we standardise the data. Standardising data adjusts for these differences and enables trust results to be more fairly compared.

As outlined in **Appendix B**, the trust-level results of the 2018 Children and Young People's Patient Experience Survey are standardised by: age group (survey version), route of admission (emergency or elective) and length of stay (0 or 1+ overnight stays).

5.3 Expected range

The 'better', 'about the same', and 'worse' categories are based on the 'expected range', which is calculated for each question for each trust. This is the range within which we would expect a particular trust to score if it performed about the same as most other trusts in the survey. The range takes into account the number of respondents from each trust, as well as the scores for all other trusts, and allows us to identify which scores we can confidently say are 'better' or 'worse' than the majority of other trusts (see **Appendix C** for more details). Analysing the survey data in such a way allows for fairer conclusions on each trust's performance. This approach presents the findings simply and in a way that takes account of multiple factors.

As the expected range calculation accounts for the number of respondents at each trust who answer a question, it is not necessary to present confidence intervals around each score for the purposes of comparing across all trusts.

5.4 Conclusions made on performance

It should be noted that the data only show performance relative to other trusts; we have not set absolute thresholds for 'good' or 'bad' performance. Thus, a trust may have a numerically "low" score for a question (e.g. 2.3 out of 10), but may still be performing "about the same" as other trusts if most trusts have low scores. Similarly, a trust may have a numerically "high" score for a question (e.g. 9.5 out of 10), but may still be performing "about the same" as other trusts if most trusts have high scores.

A separate report, which explores how overall results between trusts vary across the country, known as an Outlier report, will be available on CQC site **http://www.cqc.org.uk/childrenssurvey** once the pre-election reporting restrictions for the 2019 general election have been lifted. This report will identify significantly higher levels of better or worse patient experience **across the entire survey questionnaire**, rather than considering performance on individual questions.

5.5 Comparing scores across trusts or across survey years

The expected range statistic is used to arrive at a judgement of how a trust is performing compared with all other trusts that took part in the survey. However, if you wish to use the scored data in another way—for example, to compare scores between two different trusts or subsets of trusts—you will need to apply an appropriate statistical test to ensure that any differences are statistically significant.

6. Further information

The results for England, and trust level results, can be found on the CQC website. Also available is a quality and methodology document which provides information about the survey development and methodology:
http://www.cqc.org.uk/childrenssurvey

The results from previous children and young people's surveys carried out between 2004 and 2016 are available at the link below. Please note that due to redevelopment work, results from the 2018 survey are only comparable with 2016:
https://nhssurveys.org/surveys/survey/01-children-patient-experience/

Full details of the methodology for the survey, including questionnaires, supporting materials, sampling instructions and the survey development report are available at:
https://nhssurveys.org/surveys/survey/01-children-patient-experience/

More information on the NHS Patient Survey Programme, including results from other surveys and a programme of current and forthcoming surveys can be found at:
www.cqc.org.uk/surveys

Appendix A: Scoring for the 2018 Children and Young People's Survey

The following describes the scoring system applied to the evaluative questions in the survey, taking question X58 "Were you involved in decisions about your care and treatment?" (see Figure A1) and question X31 "How would you rate the facilities for parents or carers staying overnight?" (see Figure A2) as examples.

For X58, the least positive response option, "No", was assigned a score of 0. The middling option, "Yes, a little", was assigned a score of 5. The most positive response, "Yes, a lot", was assigned a score of 10. Lastly, if the respondent selected "I did not want to be involved", their response was treated as "not applicable", and no score was assigned for this question.

Figure A1 Scoring example: Question X58

X58 Were you involved in decisions about your care and treatment?	
Yes, a lot	10
Yes, a little	5
No	0
I did not want to be involved	Not applicable

Where a number of response options were available between the most negative and most positive response options, scores were assigned at equal intervals between 0 and 10. For example, for X31, on the facilities for parents or carers staying overnight, the following response options were available:

- Very good
- Good
- Fair
- Poor
- Very poor

The most positive response option, "Very good", was assigned a score of 10. The second most positive, "Good", was assigned a score of 7.5. The middling option "Fair" was assigned a score of 5. The second least positive response "Poor" was assigned a score of 2.5. Lastly, the least positive response option, "Very poor", was assigned a score of 0 (see below).

Figure A2 Scoring example: Question X31

X31 How would you rate the facilities for parents or carers staying overnight?	
Very good	10
Good	7.5
Fair	5
Poor	2.5
Very poor	0

All analysis is carried out on a "cleaned" data set. Cleaning refers to the editing process that is undertaken on the survey data. A document describing this can be accessed **here**.

As part of the cleaning process, responses are removed for any trust that has fewer than 30 respondents to a question. This is because the uncertainty around the result is too great and, moreover, very low numbers might risk respondents being identified from their responses.

For clarity, please note that, in any instances of low numbers of respondents to questions, such responses would be cleaned for all other outputs. As such, they are not included in the anonymised data set submitted to the UK Data Archive.

The below details the scoring allocated to each of the scored questions.

Key:
- Question asked to parents or carers of children aged 0-7
- Question asked to parents or carers of children and young people aged 0-15
- Question asked to children and young people aged 8-15
- Question asked to children 8-11
- Question asked to young people aged 12-15

Parents' questions

X3. Did the hospital give you a choice of admission dates?	
Yes	10
No	0
Don't know / can't remember	-

X4. Did the hospital change your child's admission date at all?	
No	10
Yes, once	5
Yes, a few times	0
Don't know / can't remember	-

X5. For most of their stay in hospital what type of ward did your child stay on?

A children's ward	10
An adult ward	0
A teenage / adolescent ward	0[2]

X6. Did the ward where your child stayed have appropriate equipment or adaptations for your child's physical or medical needs?

Yes, definitely	10
Yes, to some extent	5
No	0
Don't know / can't remember	-
They did not need equipment or adaptations	-

X7. How clean do you think the hospital room or ward was that your child was in?

Very clean	10
Quite clean	6.7
Not very clean	3.3
Not at all clean	0

X8. Was your child given enough privacy when receiving care and treatment?

Yes, always	10
Yes, sometimes	5
No	0

X9. Were there enough things for your child to do in the hospital

Yes, definitely	10
Yes, to some extent	5
No	0
Can't remember / I did not notice	-

X10. Did staff play with your child at all while they were in hospital?

Yes	10
No, but I would have liked this	0
No, but I didn't want / need them to do this	-
Don't know / can't remember	-

X11. If your child used the hospital Wi-Fi to entertain themselves, was it good enough to do what they wanted?

Yes, always	10
Yes, sometimes	5
No	0
Don't know / not applicable	-

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[2] Scoring for the *'A teenage / adolescent ward'* differs by age group: 0-7 '0/10', 8-11 '5/10', 12-15 '10/10'

X12. Did new members of staff treating your child introduce themselves?

Yes, always	10
Yes, sometimes	5
No	0

X13. Did members of staff treating your child give you information about their care and treatment in a way that you could understand?

Yes, definitely	10
Yes, to some extent	5
No	0

X14. Did members of staff treating your child communicate with them in a way that your child could understand?

Yes, definitely	10
Yes, to some extent	5
No	0

X15. Did a member of staff agree a plan for your child's care with you?

Yes	10
No	0
Don't know / can't remember	-

X16. Did you have confidence and trust in the members of staff treating your child?

Yes, always	10
Yes, sometimes	5
No	0

X17. Did staff involve you in decisions about your child's care and treatment?

Yes, definitely	10
Yes, to some extent	5
No	0
I did not want to be involved	-

X18. Were you given enough information to be involved in decisions about your child's care and treatment?

Yes, definitely	10
Yes, to some extent	5
No	0

X19. Did hospital staff keep you informed about what was happening whilst your child was in hospital?

Yes, definitely	10
Yes, to some extent	5
No	0
Don't know / can't remember	-

X20. Were you able to ask staff any questions you had about your child's care?

Yes, definitely	10
Yes, to some extent	5
No	0
I did not want / need to ask any questions	-
Don't know / can't remember	-

X21. Did different staff give you conflicting information?

Yes, a lot	0
Yes, sometimes	5
No, never	10

X22. Were the different members of staff caring for and treating your child aware of their medical history?

Yes, definitely	10
Yes, to some extent	5
No	0
Don't know / not applicable	-

X23. Did you feel that staff looking after your child knew how to care for their individual or special needs?

Yes, definitely	10
Yes, to some extent	5
No	0
Don't know / not applicable	-

X24. Were members of staff available when your child needed attention?

Yes, always	10
Yes, sometimes	5
No	0
Don't know / not applicable	-

X25. Did the members of staff caring for your child work well together?

Yes, definitely	10
Yes, to some extent	5
No	0
Don't know / can't remember	-

X26. If you had been unhappy with your child's care and treatment, do you feel that you could have told hospital staff?

Yes, always	10
Yes, sometimes	5
No	0

X27. Did your child like the hospital food provided?

Yes, definitely	10
Yes, to some extent	5
No	0
My child did not have hospital food	-

X28. Did you have access to hot drinks facilities in the hospital? (cross all that apply)[3]

I used a kitchen area / parents room attached to the ward	10
I used a hospital café / vending machine	10
I was allowed to use the staff room	10
I was offered drinks by members of staff	10
No	0

X29. Were you able to prepare food in the hospital if you wanted to?

Yes, definitely	10
Yes, to some extent	5
No	0
I did not want to prepare food	-

X31. How would you rate the facilities for parents or carers staying overnight?

Very good	10
Good	7.5
Fair	5
Poor	2.5
Very poor	0

X32. If your child felt pain while they were at the hospital, do you think staff did everything they could to help them?

Yes, definitely	10
Yes, to some extent	5
No	0
My child did not feel any pain	-

X34. Before your child had any operations or procedures did a member of staff explain to you what would be done?

Yes, completely	10
Yes, to some extent	5
No	0
I did not want an explanation	-

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[3] The maximum score possible for question X28 was 10 even if a respondent was able to access hot drinks in a variety of ways.

X35. Before the operations or procedures, did a member of staff answer your questions in a way you could understand?

Yes, completely	10
Yes, to some extent	5
No	0
I did not have any questions	-

X36. During any operations or procedures, did staff play with your child or do anything to distract them?

Yes, definitely	10
Yes, to some extent	5
No	0
It was not necessary	-

X37. Afterwards, did staff explain to you how the operations or procedures had gone?

Yes, completely	10
Yes, to some extent	5
No	0
I did not want an explanation	-

X38. Did a staff member give you advice about caring for your child after you went home?

Yes, definitely	10
Yes, to some extent	5
No	0
It was not necessary	-
Don't know / can't remember	-

X39. Did a member of staff tell you who to talk to if you were worried about your child when you got home?

Yes, definitely	10
Yes, to some extent	5
No	0
It was not necessary	-
Don't know / can't remember	-

X40. When you left hospital, did you know what was going to happen next with your child's care?

Yes, definitely	10
Yes, to some extent	5
No	0
It was not necessary	-

X41. Were you given any written information (such as leaflets) about your child's condition or treatment to take home with you?

Yes	10
No, but I would have liked it	0
No, but I did not need it	-

X42. Do you feel that the people looking after your child listened to you?

Yes, always	10
Yes, sometimes	5
No	0

X43. Do you feel that the people looking after your child were friendly?

Yes, always	10
Yes, sometimes	5
No	0

X44. Do you feel that your child was well looked after by the hospital staff?

Yes, always	10
Yes, sometimes	5
No	0

X45. Do you feel that you (the parent/carer) were well looked after by hospital staff?

Yes, always	10
Yes, sometimes	5
No	0

X46. Were you treated with dignity and respect by the people looking after your child?

Yes, always	10
Yes, sometimes	5
No	0

X47. Overall...

I felt that my child had a very poor experience (0)	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
I felt that my child had a very good experience (10)	10

Children and young people's questions

X48. Did hospital staff play with you or do any activities with you while you were in hospital?

Yes, a lot	10
Yes, a little	5
No	0
I did not want or need them to	-

X49. Was the ward suitable for someone of your age?

Yes	10
Sort of	5
No	0

X50. Were there enough things for you to do in the hospital?

Yes	10
Sort of	5
No	0

X51. If you used the hospital Wi-Fi, was it good enough to do what you wanted?

Yes, always	10
Yes, sometimes	5
No	0
I did not use Wi-Fi	-

X52. Did you like the hospital food?

Yes	10
Sort of	5
No	0
I did not have hospital food	-

X53. Was it quiet enough for you to sleep when needed in the hospital?

Yes, always	10
Yes, sometimes	5
No	0
I did not need to sleep in the hospital	-

X54. Did hospital staff talk with you about how they were going to care for you?

Yes	10
Sort of	5
No	0
Don't know / can't remember	-

X55. When the hospital staff spoke with you, did you understand what they said?

Yes, always	10
Yes, sometimes	5
No	0
Don't know / can't remember	-

X56. Did you feel able to ask staff questions?

Yes	10
No	0
I did not have any questions	-

X57. Did the hospital staff answer your questions?

Yes	10
Sort of	5
No	0

X58. Were you involved in decisions about your care and treatment?

Yes, a lot	10
Yes, a little	5
No	0
I did not want to be involved	-

X59. If you had any worries, did a member of staff talk with you about them?

Yes	10
No	0
I did not have any worries	-
I did not want to talk to staff	-

X60. Were you given enough privacy when you were receiving care and treatment?

Yes, always	10
Yes, sometimes	5
No	0

X61. If you wanted, were you able to talk to a doctor or nurse without your parent or carer being there?

Yes	10
No	0
I didn't want to talk to them alone	-

X62. If you felt pain while you were at the hospital, do you think staff did everything they could to help you?

Yes	10
Sort of	5
No	0
I did not feel any pain	-

X64. Before the operations or procedures, did hospital staff explain to you what would be done?

Yes	10
Sort of	5
No	0

X65. Afterwards, did staff explain to you how the operations or procedures had gone?

Yes	10
Sort of	5
No	0

X66. Did a member of staff tell you who to talk to if you were worried about anything when you got home?

Yes	10
Sort of	5
No	0
Don't know / can't remember	-

X67. When you left hospital, did you know what was going to happen next with your care?

Yes	10
Sort of	5
No	0

X68. Did a member of staff give you advice on how to look after yourself after you went home?

Yes	10
Sort of	5
No	0
I did not need any advice	-

X69. Do you feel that the people looking after you were friendly?

Yes, always	10
Yes, sometimes	5
No	0

X70. Overall, how well do you think you were looked after in hospital?

Very well	10
Quite well	7.5
OK	5
Quite badly	2.5
Very badly	0

Appendix B: Calculating the trust score and category

Calculating trust scores

The scores for each question were calculated using the method described below.

Weights were calculated to adjust for any variation between trusts that resulted from differences in the age group, length of stay and route of admission of respondents. A weight was calculated for each respondent by dividing the national proportion of respondents in their age group/ length of stay/ admission type by the corresponding trust proportion. The reason for weighting the data was that respondents may answer questions differently, depending on certain characteristics. If a trust had a large population of very young patients, their performance might be judged more harshly (or better) than if there was a more consistent distribution of patient ages across all trusts.

Weighting survey responses

The first stage of the analysis involved calculating national age/ length of stay/ admission method proportions. It must be noted that the term 'national proportion' is used loosely here as it was obtained from pooling the survey data from all trusts. The national proportions are therefore based on the respondent population, rather than the entire population of England.

Age group is derived from the version of the questionnaire patients received: 0-7, 8-11 or 12-15. Length of stay is derived from sample information, with respondents grouped as 0 (zero overnight stays) or 1(one or more overnight stays).

Question X2 asked "Was your child's visit to hospital planned or an emergency?" Respondents that ticked "Emergency (went to A&E / Casualty / came by ambulance etc)" were classed as emergency patients for the purpose of the weightings. Those who ticked "Planned visit / was on the waiting list" were classed as elective patients. If respondents did not answer question X2, information was taken from sample information.

As shown in Figure B1, the proportion of respondents who were admitted as emergencies, aged 8-11 and stayed for zero nights is **0.042**; the proportion of respondents who were admitted as emergencies, aged 8-11 and stayed for more than one night is **0.049** etc.

Figure B1 National Proportions

Admission Method	Length of stay	Age Group	National proportion 2018
Emergency	Zero nights	0-7	0.196
		8-11	0.042
		12-15	0.041
	One night or more	0-7	0.227
		8-11	0.049
		12-15	0.057
Elective	Zero nights	0-7	0.130
		8-11	0.087
		12-15	0.096
	One night or more	0-7	0.039
		8-11	0.016
		12-15	0.020

Note: All proportions are given to three decimals places for this example. The analysis included these figures to 14 decimal places and can be provided on request from the CQC surveys team at patient.survey@cqc.org.uk.

These proportions were calculated for each trust, using the same procedure.

The next step was to calculate the weighting for each individual. Age group/ length of stay/ admission type weightings were calculated for each respondent by dividing the national proportion of respondents in their age group/ length of stay/ admission type by the corresponding trust proportion.

If, for example, a lower proportion of emergency patients aged 8 to 11 who spent zero nights in hospital responded to the survey, in comparison with the national proportion, then this group would be under-represented in the final scores. Dividing the national proportion by the trust proportion results in a weighting greater than "1" for members of this group. This increases the influence of responses made by respondents within that group in the final score, thus counteracting the low representation.

Likewise, if a considerably higher proportion of emergency patients aged 8-11 who spent one or more nights in hospital responded to the survey, in comparison with the national proportion, then this group would be over-represented in the final scores. Subsequently this group would have a greater influence over the final score. To counteract this, dividing the national proportion by the proportion for Trust A results in a weighting of less than one for this group.

Figure B2 Proportion and Weighting for Trust A

Admission Method	Length of stay	Age Group	National proportion 2018	Trust A Proportion	Trust A Weight (National/Trust A)
Emergency	Zero nights	0-7	0.196	0.071	2.757
		8-11	0.042	0.048	0.887
		12-15	0.041	0.051	0.817
	One night or more	0-7	0.227	0.078	2.918
		8-11	0.049	0.064	0.759
		12-15	0.057	0.061	0.935
Elective	Zero nights	0-7	0.130	0.108	1.201
		8-11	0.087	0.209	0.417
		12-15	0.096	0.169	0.569
	One night or more	0-7	0.039	0.057	0.679
		8-11	0.016	0.034	0.468
		12-15	0.020	0.051	0.404

Note: All proportions are given to three decimals places for this example.

To prevent the possibility of excessive weight being given to respondents in an extremely underrepresented group, the maximum value for any weight was set at 5.

Calculating question scores

The trust scores for each question displayed on the CQC website and in benchmark reports, were calculated by applying the weighting for each respondent to the scores allocated to each response.

The responses given by each respondent were entered into a dataset using the 0-10 scale described in Appendix A. Each row corresponded to an individual respondent, and each column related to a survey question. For those questions that the respondent did not answer (or received a "not applicable" score for), the relevant cell remained empty. Alongside these were the weightings allocated to each respondent.

Figure B3 Example scoring for the operations and procedures questions asked to children and young people aged 8-15, Trust A

Respondent	Scores		Weight
	X64	X65	
1	10	0	0.929
2	5	10	1.143
3	.	5	1.357

Respondents' scores for each question were then multiplied individually by the relevant weighting, in order to obtain the numerators for the trust scores.

Figure B4 Example numerators for the operations and procedures questions asked to children and young people aged 8-15, Trust A

Respondent	Scores		Weight
	X64	X65	
1	9.290	0	0.929
2	5.715	11.43	1.143
3		6.785	1.357

Obtaining the denominators for each domain score

A second dataset was then created. This contained a column for each question and again with each row corresponding to an individual respondent. A value of one was entered for the questions where a response had been given by the respondent, and all questions that had been left unanswered or allocated a scoring of "not applicable" were set to missing.

Figure B5 Example values for non-missing responses for the operations and procedures questions asked to children and young people aged 8-15, Trust A

Respondent	Scores		Weight
	X64	X65	
1	1	1	0.929
2	1	1	1.143
3		1	1.357

The denominators were calculated by multiplying each of the cells within the second dataset by the weighting allocated to each respondent. This resulted in a figure for each question that the respondent had answered. Again, the cells relating to the questions that the respondent did not answer (or received a 'not applicable' score for) remained set to missing.

Figure B6 Denominators for the operations and procedures questions asked to children and young people aged 8-15, Trust A

Respondent	Score		Weight
	X64	X65	
1	0.929	0.929	0.929
2	1.143	1.143	1.143
3		1.357	1.357

The weighted mean score for each trust, for each question, was calculated by dividing the sum of the weighted scores for a question (i.e. numerators), by the weighted sum of all eligible respondents to the question (i.e. denominators) for each trust.

Using the example data for Trust A, we calculated weighted mean scores for each question.

X64: $\dfrac{9.290 + 5.715}{0.929 + 1.143}$ = 7.242

X65: $\dfrac{0.000 + 11.43 + 6.785}{0.929 + 1.143 + 1.357}$ = 5.312

This process is followed for each scored question within the survey.

Appendix C: Calculation of the expected ranges

Z statistics (or *Z* scores) are standardized scores derived from normally distributed data, where the value of the *Z* score translates directly to a *p*-value. That *p*-value then translates to what level of confidence you have in saying that a value is significantly different from the mean of your data (or another target value).

A standard *Z* score for a given item is calculated as:

$$z_i = \frac{y_i - \theta_0}{s_i} \quad (1)$$

where: s_i is the standard error of the trust score[4],
           y_i is the trust score
           θ_0 is the mean score for all trusts

Under this banding scheme, a trust with a *Z* score of < -1.96 is labeled as 'Worse' (significantly below average; *p* <0.025 that the trust score is below the England average), -1.96 < *Z* < 1.96 as 'About the same', and *Z* > 1.96 as 'Better' (significantly above average; *p* < 0.025 that the trust score is above the England average) than what would be expected based on the distribution of trust scores for England.

However, for measures where there is a high level of precision in the estimates (the survey sample sizes average around 400 to 500 per trust), the standard *Z* score may give a disproportionately high number of trusts in the significantly above/ below average bands (because s_i is generally so small). This is compounded by the fact that all the factors that may affect a trust's score cannot be controlled. For example, if trust scores are closely related to economic deprivation then there may be significant variation between trusts due to this factor, rather than factors within the trusts' control. In this situation, the data are said to be 'over dispersed'. That problem can be partially overcome by the use of an 'additive random effects model' to calculate the *Z* score (we refer to this modified *Z* score as the Z_D score). Under that model, we accept that there is natural variation between trust scores, and this variation is then taken into account by adding this to the trust's local standard error in the denominator of (1). In effect, rather than comparing each trust simply to one target value for England, we are comparing them to an England distribution.

The Z_D score for each question and section was calculated as the trust score minus the England mean score, divided by the standard error of the trust score plus the variance of the scores between trusts. This method of calculating a Z_D score differs from the standard method of calculating a *Z*-score in that it recognizes that there is likely to be natural variation between trusts which one should expect and accept. Rather than comparing each trust to one point only (i.e. the England mean score), it compares each trust to a distribution of acceptable scores. This is achieved by adding some of the variance of the scores between trusts to the denominator.

The steps taken to calculate Z_D scores, based on the method presented in Spiegelhalter et al. (2012), are outlined below.

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[4] Calculated using the method in Appendix D.

Winsorising Z-scores

The first step when calculating Z_D is to 'Winsorise' the standard Z scores (from (1)). Winsorising consists of shrinking in the extreme Z-scores to some selected percentile, using the following method:

1. Rank cases according to their naive Z-scores.

2. Identify Z_q and $Z_{(1-q)}$, the 100q% most extreme top and bottom naive Z-scores. For this work, we used a value of q=0.1

3. Set the lowest 100q% of Z-scores to Z_q, and the highest 100q% of Z-scores to $_{(1-q)}$. These are the Winsorised statistics.

This retains the same number of Z-scores but discounts the influence of outliers.

Estimation of over-dispersion

An over dispersion factor $\hat{\phi}$ is estimated for each indicator which allows us to say whether the data for that indicator are over dispersed or not:

$$\hat{\phi} = \frac{1}{I} \sum_{i=1}^{I} z_{,i}^2 \quad (2)$$

where I is the sample size (number of trusts) and z_i is the Z-score for the ith trust given by (1). The Winsorised Z-scores are used in estimating $\hat{\phi}$.

An additive random effects model

If $I\hat{\phi}$ is greater than (I - 1) then we need to estimate the expected variation between trusts. We take this as the standard deviation of the distribution of θ_i (trust means) for trusts, which are on target, we give this value the symbol $\hat{\tau}$, which is estimated using the following formula:

$$\hat{\tau}^2 = \frac{I\hat{\phi} - (I-1)}{\sum_i w_i - \sum_i w_i^2 / \sum_i w_i} \quad (3)$$

where $w_i = 1 / s_i^2$ and $\hat{\phi}$ is from (2). Once $\hat{\tau}$ has been estimated, the Z_D score is calculated as:

$$z_i^D = \frac{y_i - \theta_0}{\sqrt{s_i^2 + \hat{\tau}^2}} \quad (4)$$

References

Spiegelhalter, D., Sherlaw-Johnson, C., Bardsley, M., Blunt, I., Wood, C., & Grigg, O. (2012). Statistical methods for healthcare regulation: Rating, screening and surveillance. *Journal of the Royal Statistical Society (Series A), 175*(1), 1-47.

Appendix D: Calculation of standard errors

To calculate statistical bandings from the data, it is necessary for CQC to have both trusts' scores for each question and section and the associated standard error. Since each section is based on an aggregation of question mean scores that are based on question responses, a standard error needs to be calculated using an appropriate methodology.

For the patient experience surveys, the z-scores are scores calculated for section and question scores, which combines relevant questions making up each section into one overall score, and uses the pooled variance of the question scores.

Assumptions and notation

The following notation will be used in formulae:

X_{ijk} is the score for respondent j in trust i to question k

Q is the number of questions within section d

w_{ij} is the standardization weight calculated for respondent j in trust i

Y_{ik} is the overall trust i score for question k

Y_{id} is the overall score for section d for trust i

Calculating mean scores

Given the notation described above, it follows that the overall score for trust i on question k is given as:

$$Y_{ik} = \frac{\sum_j w_{ij} X_{ijk}}{\sum_j w_{ij}}$$

The overall score for section d for trust i is then the average of the trust-level question means within section d. This is given as:

$$Y_{id} = \frac{\sum_{k=1}^{Q} Y_{ikd}}{Q}$$

Calculating standard errors

Standard errors are calculated for both questions and sections.

For questions, the variance of the trust score is estimated with the Taylor series linearization method (see e.g. Lee & Forthofer, 2006; Lumley, 2004). The standard error of the trust score, s_i, is the square root of the Taylor series estimate of variance.

For sections, the variance within trust i on question k is given by:

$$\hat{\sigma}_{ik}^2 = \frac{\sum_j w_{ij} \left(X_{ijk} - Y_{ik} \right)^2}{\sum_j w_{ij}}$$

This assumes independence between respondents.

For ease of calculation, and as the sample size is large, we have used the biased estimate for variance.

The variance of the trust-level average question score, is then given by:

$$V_{ik} = Var(Y_{ik}) = Var\left(\frac{\sum_j w_{ij} X_{ijk}}{\sum_j w_{ij}} \right)$$

$$= \frac{Var\left(\sum_j w_{ij} X_{ijk} \right)}{\left(\sum_j w_{ij} \right)^2}$$

$$= \frac{\hat{\sigma}_{ik}^2 \sum_j w_{ij}^2}{\left(\sum_j w_{ij} \right)^2}$$

Covariances between pairs of questions (here, k and m) can be calculated in a similar way:

$$COV_{ik.im.} = Cov(Y_{ik}, Y_{im}) = \frac{\hat{\sigma}_{ikm} \sum_j w_{ij}^2}{\left(\sum_j w_{ij} \right)^2}$$

Where $\hat{\sigma}_{ikm} = \dfrac{\sum_j w_{ij} (X_{ijk} - Y_{ik})(X_{ijm} - Y_{im})}{\sum_j w_{ij}}$

Note: w_{ij} is set to zero in cases where patient j in trust i did not answer both questions k and m.

The trust-level variance for the section score *d* for trust *i* is given by:

$$V_{id} = Var(Y_{id}) = \frac{1}{Q^2}\left\{\sum_{k=1}^{Q} V_{ik} + 2\sum_{k=2}^{Q}\sum_{m=1}^{k-1} COV_{ik,im}\right\}$$

The standard error of the section score is then:

$$SE_{id} = \sqrt{V_{id}}$$

This simple case can be extended to cover sections of greater length.

References

Lee, E. S., & Forthofer, R. N. (2006). *Analyzing complex survey data* (2nd ed.). Thousand Oaks, CA: Sage. http://dx.doi.org/10.4135/9781412983341

Lumley, T. (2004). Analysis of complex survey samples. *Journal of Statistical Software*, *9.* doi: 10.18637/jss.v009.i08