Applying Qualitative Comparative Analysis (QCA) in public health: A case study of a health improvement service for long-term Incapacity Benefit recipients.

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Abstract

Background: This paper explores the value of Qualitative Comparative Analysis (QCA) in public health research using the example of a pilot case management intervention for long-term Incapacity Benefit recipients. It uses QCA to examine how the 'health improvement' effects of the intervention varied by individual and service characteristics.

Methods: Data for 131 participants receiving the intervention were collected over nine months. Health improvement was measured using the EQ-VAS. Socio-demographic, health behaviour data were also collected. Data on service use was obtained from the provider's client records. Crisp set QCA was conducted to identify which individual and service characteristics were most likely to produce a health benefit after participation in the intervention.

Results: Health improvement was most likely amongst younger participants, men aged over 50 and those with an occupational history of skilled manual work or higher; and less likely amongst older women, those with a musculoskeletal condition, and those with semi- or un-skilled backgrounds. Service characteristics had no impact.

Conclusions: The QCA identified potential causal pathways for health improvement from the intervention with important potential implications for tackling health inequalities. QCA should be considered as a viable and practical method in the public health evaluation tool box.

Word count = 197

BACKGROUND

There have been growing calls for public health researchers to develop more appropriate methods for the evaluation of complex interventions [1]. Generally, methodological development in response to such calls has drawn on the medical sciences and epidemiology with particular reference to the expanded use of RCTs and systematic reviews [2]. However, in this paper we argue that public health research could also benefit from adapting the tools used in the social sciences. QCA is a good example of an under-utilised social science methodology which could have public health research application [3].

QCA was developed by Ragin, initially in relation to comparative political science [4, 5, 6, 7, 8). It has since been developed and applied by various researchers across the social sciences (see for example, [9 ,10, 11, 12, 13, 14, 15, 16] reflecting how social science theory has sought to take account of increased complexity, with policy-oriented work particularly concerned with how interventions work across heterogeneous contexts [17, 18,19, 20]. QCA is a case-oriented method that allows systematic comparison of cases as configurations of set memberships based on their attributes and the relationship of these to particular outcomes. QCA thereby provides an alternative to conventional quantitative approaches which are generally concerned with isolating the independent effect of one variable whilst controlling for the influence of others [3]. Instead, QCA allows for interactions between multiple attributes and recognises that the same outcomes may be generated by different configurations of attributes: in other words, QCA addresses multiple causation. QCA transforms cases into configurations or combinations of factors (or stimuli, causal variables, determinants etc.) that are referred to as 'conditions' that produce a given outcome of interest [9]. The key question that QCA therefore seeks to address is which conditions (or combinations of) are 'necessary' or 'sufficient' to produce the outcome. A condition is necessary for an outcome if it is always present when the outcome occurs - the outcome cannot occur in the absence of the condition. A condition is sufficient for an outcome if the outcome always occurs when the condition is present - although the outcome could also result from other conditions ([9]: xix).

QCA is therefore of potential use in the evaluation of the effectiveness of complex public health interventions as applied to small populations, particularly in terms of identifying which aspects of a multi-faceted intervention, or the individual characteristics of participants, are most likely to impact on the effectiveness of an intervention. However, QCA remains a novel and under-utilised methodology in the field of public health evaluation with only a few previous applications [21, 3]. For example, Blackman used it to explore factors associated with trends in narrowing health inequalities in England [3, 22] and in smoking cessation services [21]. In this paper we build on the public health application of QCA methodology developed by Blackman et al [3, 22] by using it in the evaluation of a complex public health intervention: case management for the health improvement of workless people in long term receipt of incapacity-related benefits.

The importance of work to population health, and of worklessness as a cause of social exclusion and health inequalities, is increasingly being recognized by policymakers [23]. For example, the UK government commissioned the Black Review of Working Age Health [24] and the National Institute for Health and Clinical Excellence (NICE) produced guidelines on incapacity and sickness absence [25, 26]. The NICE guidelines concluded that case management approaches were the most effective in helping workless people in receipt of incapacity-related benefits (IB) return to work. Following the guidance, a Primary Care Trust (PCT) in the North East of England commissioned a pilot 'health first' case management service with the aim of improving the health (and therefore the employability) of long term IB recipients. In a previous publication, we reported that the case management service was effective and cost-effective in improving the general and mental health of participants [27]. In this paper, we present a more detailed analysis of the intervention to get behind these 'headline' findings. Using QCA methods, we explore how the 'health improvement' effects of the intervention varied by (1) individual participant characteristics and (2) service characteristics.

METHOD

Study Design

The Primary Care Trust commissioned an external agency to provide a pilot 'health first' case management approach for long-term IB recipients (of 3 years or more). This pilot programme used telephone and face to face case management programmes to identify individual health needs and any other related barriers to employment (such as debt or housing). The scheme was intended to complement mainstream services with case-managers signposting the patients to NHS, Department for Work and Pensions and other health and welfare services. They also referred patients to a physiotherapy service and a counseling service which they provided as part of the service. Patients were referred onto the programme by other NHS services (such as the Alcohol Service), their GPs, or they could self-refer. The length of engagement with the service varied according to the needs of each service user with an average duration of six months.

Anonymised data were collected for the 131 individuals who were recruited to the pilot intervention between September 2009 and June 2010. Data were collected prospectively using questionnaires at base line (T1), 3 months (the intervention's midpoint, T2), 6 months (the intervention's endpoint, T3) and 9 months (three months post-intervention, T4). Socio-demographic (gender, age, housing tenure), social capital, (frequency of contact with neighbours, family and friends) and work history (previous jobs time spent in the job, time spent on IB) data were collected. The questions were taken from large scale surveys such as the General Household Survey (GHS) and the British Household Panel Survey (BHPS). The baseline sample characteristics are set out in Table 1.

Health was measured using a range of generic (EQ-5D, EQ-VAS, SF-8), disease-specific (HADS, Nordic Musculoskeletal questionnaire) and health behaviour (tobacco and alcohol consumption) outcomes. For this analysis we only use the EQ-VAS – the EuroQual Visual Analogue Scale, often known as a 'Health Thermometer' due to the show card which is used. Participants are asked to rate their health on the day they are interviewed on a scale of 0 -100. 0 represents the

worst health state the participant can imagine, 100 represents the best health state they can imagine with 50 representing the midpoint. Health improvement was defined in relation to movement towards the UK population norm EQ-VAS score of 82.48 [28]. We did so by producing relative differences with the UK population norm for each of the cases between T1 and T4. Further anonymised, individual-level data on the characteristics of the case management intervention was obtained from the service provider. These records contained details of the referral route, the treatments received, the treatment providers and the frequency of treatment.

Qualitative Comparative Analysis

The specific QCA technique employed is known as 'crisp set' QCA. This is based on Boolean algebra, which uses binary data based on a condition being either present or absent (variables with values of 1 or 0, such as 'yes' or 'no'). It therefore relies on the dichotomization of variables. Our analysis method is summarised in Table 2. The dataset contained 130 individual and 'service use' characteristics, these needed to be reduced because conducting a QCA with six characteristics has 64 (i.e. 2^6) possible combinations, whereas one with nine conditions has 512 (i.e. 2^9) possible combinations. Following the approach adopted by Blackman et al [22] we reduced the number of characteristics of interest to 12 by including only those that had any patterned relationship, or 'skews' with the outcome. fsQCA software was used to explore their effects in combination. Approximately 40 combinations, through adding and removing conditions, were explored before the most parsimonious solution presented in Table 3 was reached – 5 characteristics. The configurations in Table 3 represent 30 of the possible 32 logical possible combinations in the property space (i.e. 2^5). A Boolean minimization was conducted, using fsQCA software, which produced 15 different groupings for the improving and not improving configurations. Given the limited utility of the Boolean minimization and logical remainders for this analysis we have chosen to focus on the configurations as they appear in Table 3.

RESULTS

Table 3 presents the QCA 'Truth Table' of individual participant characteristics. This produced four prominent groupings that exhibited a relationship with health improvement outcomes: younger men (Table 3, configurations 2, 3, 13, 20 and 21), younger women (Table 3, configurations 1, 6, 9, 12 and 16), older men (Table 3, configurations 4, 5, 8, 10, 11, 15 and 18) and older women (Table 3, configurations 7, 14, 17, 19, 22 and 23). The characteristics which combined in each age and gender group to produce either a health improvement outcome (0.75 and above in the 'consistency' column of Table 3) or no health improvement outcome (0 to 0.24 in the 'consistency' column of Table 3) configurations were: primary health problem, skill level of last paid job, and social contact in terms of the frequency which participants spoke to their neighbours. Contradictory configurations (having an observed consistency score of 0.25 to 0.75, see [8]) are not discussed here as they require further in-depth QCA analysis. There are no freestanding 'necessary' or 'sufficient' characteristics in the data. However, each of the configurations that is 100% consistent (e.g. configuration 9 is 1.0 in the 'consistency' column of Table 3) is 'sufficient' because only one outcome (e.g. health improvement for 9) occurs with this configuration. None of the full configurations (consistency score of 1.0) produced here are 'necessary' because health improvement or not does not only occur in relation to this configuration.

Younger men (Table 3, configurations 2,3,13, 20 and 21) in configurations 2 and 3 (13 participants) demonstrated health improvement after participation in the intervention. Further common features of these participants were that they did not suffer from a musculoskeletal problem as their primary health problem and that they did not speak to their neighbours on a weekly basis (i.e. they spoke to them more or less frequently). Two further participants (configuration 13) saw a health improvement but had a musculoskeletal health problem and spoke to their neighbours on a weekly basis, and had an occupational background of skilled manual or higher. Those younger men in configurations 20 and 21 (four participants) did not experience a health improvement. These cases appear to have a 'necessary' combination of

conditions for younger men because all had a musculoskeletal primary health problem and an occupational background of semi-skilled or unskilled manual work in their previous employment. Social contact had little impact here as the 'not improving' health outcome occurred regardless of the presence or absence of this characteristic.

Younger women (Table 3, configurations 1, 6, 9, 12 and 16) in configurations 1, 6, 9 and 12 (17 cases) all experienced a health improvement outcome. The common characteristic that these configurations shared was that they did not speak to their neighbours on a weekly basis. This appears to be a 'necessary' and 'sufficient' condition for health improvement within this age and gender group. Those in configuration 16 (four participants) did not experience a health improvement outcome. They did not have a musculoskeletal primary health problem, they had semi-skilled or unskilled backgrounds and they spoke to their neighbours on a weekly basis. This final feature contrasts with those from this age /gender group whose health did improve and confirms both the 'necessary' and 'sufficient' nature of this condition for a health improvement outcome.

Older men (Table 3, configurations 4, 5, 8, 10, 11, 15 and 18) in configurations 4, 5, 8, 10, 11 and 15 (16 participants) experienced improved health. There was a variety of configurations leading to this outcome and so no clear pathway for health improvement amongst this group. For example, configurations 5, 8, and 10 (nine participants) shared the common feature that they did not speak to neighbours on a weekly basis whilst configurations 4, 11 and 15 (seven participants) experienced a health improvement but spoke to their neighbours on a weekly basis. Similarly split configurations were found for occupational background (configurations 4, 5 and 15 compared to 8, 9 and 11) and primary health problems (configurations 4, 10 and 11 compared to 5, 8 and 15). Therefore, for this age and gender grouping, the pattern to health improvement was less clear than for the other groupings. For older men, the characteristics indicating a lack of health improvement were less ambiguous than for those in the 'health improving' group as those in configuration 18 (three participants) spoke to their neighbours on a weekly basis, their

occupational backgrounds were semi-skilled or unskilled, and all had primary health problems that were musculoskeletal in nature. Consequently, this configuration of cases of older men had all of the apparently receptive characteristics 'absent'. This was a 'necessary' and 'sufficient' combination for this age and gender group.

Older women (Table 3, configurations 7, 14, 17, 19, 22 and 23) in configurations 7 and 14 (two participants) saw their health improve. These older women shared the 'necessary' combination of having a primary health problem that was not musculoskeletal in its nature and an occupational background of skilled manual work or higher. Those in configurations 17, 19, 22, and 23, (seven participants) did not have a health improvement. None of these configurations shared the 'necessary' combination of a non-musculoskeletal primary health problem and a higher skilled occupational background. This illustrates the significance of the necessary combination of conditions in the health improving group. Furthermore, this also suggests that older women were less likely to have benefitted from the intervention.

In terms of service characteristics and treatment combinations (e.g. frequency of contact, type of referral, type of service inputs such as physiotherapy or counselling), only one of the ten conditions (the number of contacts with the provider of the intervention) demonstrated a relationship with the health improvement outcome. However, when it was entered into fsQCA alongside the individual characteristics it did not produce a more consistent or parsimonious 'truth table' suggesting that the individual-level characteristics detailed above had a much more significant impact upon health improvement after the intervention, rather than the nature of the treatment they received through the intervention. Consequently, it was not appropriate to include the service characteristics in the final QCA results.

DISCUSSION

The main findings of this study

The key factors in predicting a health improvement (in the form of an improved EQ5-D VAS score) after participation in the case management intervention were age, gender, primary health problem, skill level in their last paid job and social contact (whether people spoke to their neighbours on a weekly basis). As the above analysis shows, combinations of these conditions produced noticeable skews in the data. Younger participants, men aged over 50 and those with an occupational history of skilled manual work or higher were more likely to experience a health improvement after participation in the intervention. Older women, those with a musculoskeletal condition and those with an occupational history of semi- or un-skilled work were less likely to experience a health improvement. Those participants who had contact with their neighbours on a weekly basis were less likely to experience a health improvement whereas those who had more or less frequent contact were more likely to have a health improvement. It is, however, important to stress that social contact and the positive and negative associations attached to it were only evident when in configuration with the other characteristics. It was very clear in the QCA that combinations of individual characteristics had more of an impact on the likelihood of health improvement than service characteristics.

What is already known on this topic?

That age and gender were the key factors identified by the QCA are not surprising in the wider context of what is already known about long-term health-related worklessness. For example, the NICE guidance on long-term sickness absence [25] noted that in order to be successful, case management needs to account for *"the person's age and gender, the condition that led to the sickness absence, their prognosis for returning to work and the type of work they are involved in"* [25]. Similarly, the occupational stratification identified in terms of health improvement between skilled and less skilled work also reflects the wider literature. For example it is well established that health-related job loss has a social gradient, with adverse employment consequences more likely for those in lower socio-economic groups [29]. This gradient also appears to be reflected in

whether case management initiatives lead to health improvement. The intervention could therefore potentially increase health inequalities between the lowest skilled (un- and semi-skilled manual) and those just above them in the occupational gradient (skilled manual) – so-called intervention generated inequality [30]. Furthermore, it is known that lower socio-economic groups are disproportionately at risk of unemployment and that it is a key determinant of the social gradient in health [31]. In other words, those from semi-skilled or unskilled working backgrounds are more likely to start from a lower health state than those with occupational background of skilled manual or better. However, the intervention still has the potential to reduce more general health inequalities by reducing the health gap those in work and those out of work [32]. The QCA has also suggested that more or less frequent social contact with neighbours than 'once a week' increases the likelihood of a health improvement. This reinforces the importance of local communities and neighbourhoods in terms of public health outcomes [33], but the somewhat contradictory finding also suggests that there are issues with how social contact is experienced that needs further analysis and a need to consider the importance of understanding the nature, problems and cultures of communities in the commissioning and delivery of services.

What this study adds

This study shows that case management interventions need to carefully consider the context within which health-related worklessness is rooted, the importance of individual characteristics in terms of the likelihood of benefitting from a health improvement intervention, and the complex ways in which such individual characteristics interact. Consequently, the use of a QCA approach in public health evaluation compared to a more traditional approach has the clear benefit of being able to provide a much more contingent analysis of what underpins success and how different factors interact to produce outcomes. This study also suggests that policy makers need to consider how people's individual and contextual characteristics interact when targeting, or planning, interventions for health improvement.

CONCLUSION

The application of QCA to the analysis of this intervention has provided an alternative approach to the more conventional methods used to evaluate complex public health interventions. By comparing cases systemically, QCA allows interactions between multiple participant attributes to be revealed and explored. This allows for the identification of 'multiple conjunctural causation'. Consequently, policy-makers can reflect on the efficacy of an intervention with specific groups. This study has identified a number of potential causal pathways for health improvement or non-improvement from the case management intervention with important potential implications for health inequalities. These configurations provide the basis for further qualitative investigation to explore causation at a more detailed (ideographic) level.

Research Ethics

This study received NHS National Research Ethics Service ethical approval from the County Durham and Tees Valley 2 Research Ethics Committee (REC reference 09/H0908/84).

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Author Contribution Statement

Principal investigator Bambra designed and oversaw all stages of the study. Data collection was conducted by Warren and data analysis was conducted by Wistow with input from Warren. Warren and Bambra drafted the article with input from Wistow.

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Bibliography

1. Craig, P; Dieppe, P; Macintyre, S; Michie, S; Nazareth, I; Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance.BMJ, 337: a1655

2. Macintyre, S (2011). Good intentions and received wisdom are not good enough: the need for controlled trials in public health. *Journal of Epidemiology and Community Health*, 65: 564-567.

3. Blackman, T., Wistow, J., and Byrne, D. (2011a). A qualitative comparative analysis of factors associated with trends in narrowing health inequalities in England. *Social Sciences and Medicine,* 72 (12), 1965-74.

4. Ragin, C.C. (1987). *The Comparative Method*. Berkeley: California University Press.

5. Ragin, C.C. (2000). *Fuzzy Set Social Science.* Chicago: Chicago University Press.

6. Ragin, C.C. 2006a. The limitations of net effects thinking. In B. Rihoux and H. Grimm (eds) *Innovative Comparative Methods for Political Analysis*. New York: Springer.

7. Ragin, C C. 2006b. Set relations in social research: evaluating their consistency and coverage. *Political Analysis* 14: 291-310.

8. Ragin, C.C. (2008). *Redesigning Social Inquiry.* Chicago: Chicago University Press.

9. Rihoux, B. and Ragin, C. (2009). Introduction. In: Rihoux, B. & Ragin, C. (eds.) *Configurational Comparative Method: Qualitative Comparative Analysis (QCA) and Related Techniques*. Los Angeles: SAGE Publications, Inc.

10. Cooper, B. (2005). *Applying Ragin's crisp and fuzzy set QCA to large datasets: social class and educational achievement in the NCDS, Sociological Research Online.* Available at: <http://www.socresonline.org.uk/10/2/cooper1.html> 20/04/10.

11. Fiss, P.C. (2009). Case studies and the Configurational Analysis of Organizational Phenomena. In: Byrne, D. & Ragin, C. C. (eds.) *Sage Handbook of Case Based Research*. London: Sage.

12. Glaesser, J., Gott, R., Roberts, R. and Cooper, B. (2009a). The roles of substantive and procedural understanding in open-ended science investigations: using fuzzy set qualitative comparative analysis to compare two different tasks. *Research in Science Education,* 39, 595-624.

13. Glaesser, J., Gott, R., Roberts, R. and Cooper, B. (2009b). Underlying success in open-ended investigations in science: using Qualitative Comparative Analysis to identify necessary and sufficient conditions. *Research in Science & Technological Education,* 27(1), 5-30.

14. Grofman, B., and Schneider, C. C. (2009). An Introduction to Crisp Set QCA, with a Comparison to Binary Logistic Regression. *Political Research Quarterly,* 62, 662-672.

15. Longest, K. and Vaisey, S. (2008). Fuzzy: A Program for Performing Qualitative Comparative Analyses (QCA) in Stata. *STATA Journal,* 8, 3-28.

16. Olsen, W., and Nomura, H. (2009). Poverty Reduction: Fuzzy Sets vs. Crisp Sets Compared. *Sociological Theory and Method,* 24, 218-246.

17. Byrne, D. (1998). *Complexity theory and the social sciences*. London: Routledge.

18. Pawson, R. and Tilley, N. (1997). *Realistic Evaluation.* London: Sage.

19. Cilliers, P. (1998). *Complexity & Postmodernism*. London: Routledge.

20. Wright, R. (2001). *Nonzero: History, Evolution and Human Cooperation*. London: Abacas.

21. Blackman, T (2008). Can smoking cessation services be better targeted to tackle health inequalities? Evidence from a cross-sectional study. *Health Education Journal*, 67: 91-101

22. Blackman, T., Wistow, J., and Byrne, D. (2011b). *Towards a new understanding of how local action can effectively address health inequalities*. Report for the National Institute for Health Research Service Delivery and Organisation programme.

23. Marmot, M. (Chair). (2010). *Fair society, Healthy Lives: the Marmot review*. London: University College.

24. Black, C. (2008). *Dame Carol Black's Review of the health of the working age population - Working for a healthier tomorrow*. London: TSO.

25. NICE (National Institute for Health and Clinical Excellence). (2009). *Public Health Guidance 19: Managing long-term sickness absence and incapacity for work.* London: NICE.

26. Gabbay, M., Taylor, L., Sheppard, L., Hillage, J., Bambra, C., Ford, F., Preece,R., Taske, N., and Kelly, M.P. (2011) National Institute for Health and Clinical Excellence (NICE) Guidance on long term sickness and incapacity. British Journal of General Practice, 61: e118-124.

27. Warren, J., Bambra, C., Kasim, A., Garthwaite, K., Mason, J., and Booth, M. Prospective evaluation of the effectiveness and cost effectiveness of a pilot 'health first' case management service for long term Incapacity Benefit recipients. Under review *Journal of Public Health*.

28. Kind, P., Hardman, G. and Macran, S. (1999). *Population Norms for EQ5D.* York University. Available at: http://www.york.ac.uk/media/che/documents/papers/discussionpapers/CHE%20Discussion%20Paper%20172.pdf

29. Beatty, C. and Fothergill, S. (2002). Hidden unemployment among men: a case study. *Regional Studies*, 36, 811-823.

30. White M, Adams J, Heywood P. How and why do interventions that increase health overall widen inequalities within populations? In Babones S (Ed.). Health, inequality and society. Bristol: Policy Press, 2009.

31. Popham, F. and Bambra, C. (2010). Evidence from the 2001 English Census on the contribution of employment status to the social gradient in self-rated health. *Journal of Epidemiology and Community Health*, 64, 277-280.

32. Bambra, C. (2013) 'Tackling health-related worklessness: a 'health first' approach', in Marmot, M. (ed) *Health Inequalities*. British Academy, London.

33. Stafford, M. and McCarthy, M. (2006). Neighbourhoods, housing and health. In M Marmot and R Wilkinson (eds) *Social Determinants of Health*, Oxford: Oxford University Press, p297-317.

Table 1: Baseline Sample Characteristics

	Intervention N=131	Intervention Frequency (mean)
Gender		
Men	49.6%	65
Women	50.4%	66
Age		
Mean (Years)	44.9	
45 years and under	43.5%	57
Over 45	56.5%	74
Marital Status		
Married	31.3%	41
Divorced	24.4%	32
Single	34.4%	45
Tenure		
Renting	58%	76
Renting (Social Housing)	59.8%	49
Transport		
No access to a motor vehicle	47.3%	62
Occupational Class (based on last job)		
Professional	5.6%	7
Intermediate	6.3%	8
Skilled Non Manual	6.3%	8
Skilled Manual	21.4%	27
Semi-Skilled	21.4%	27
Unskilled	38.9%	49
Workless Households	74%	97
Time spent on IB/ESA		
Mean (months)	98	
Mode (months)	36	
Primary Health Problem		
Musculo-Skeletal	38%	49
Mental Health	48.1%	62
Digestive/Gastric	3.1%	4
Cardiovascular	5.4%	7
Respiratory	3.1%	4

	Intervention N=131	Intervention Frequency (mean)
Other	2.3%	3
Multiple (3 or more) Health problems	43.4%	56
Seen health practitioner in past 30 days	81.7%	107
Speaking to Neighbours		
On most days	20.6%	27
Once a week	35.1%	46
Once or twice a month	9.9%	13
Less than once a month	15.3%	20
Never	19.1%	25
Smoking and Drinking		
Regular Smokers	42.7%	56
Drink Alcohol	61.1%	80
Average Units per week consumed	24.6 units	
Health Status		
EQ5D-VAS	42.08	

Table 2: Stages of QCA Analysis

1) Establish whether individuals were improving or not improving their self-reported health (EQ5-DVAS) compared to the UK population norm score of 82.48.
2) Produce cross tabulations for each 'condition' against the outcome measures to clarify which conditions were associated with improving or not improving health.
3) Categorise the conditions (through a process of dichotomisation) as 'present' or 'absent' in relation to the outcome measure.
4) Draw up a shortlist of those conditions associated with either improving or not improving outcomes. Those conditions with no strong association were not included in the shortlist.
5) Enter the shortlisted conditions associated with improving or not improving health into fsQCA software.
6) Explore different iterations and combinations by adding and removing shortlisted conditions using fsQCA software to identify the most parsimonious configurations associated with both improving and not improving health.
7) Conduct Boolean minimization using fsQCA software.
8) Further investigate the full dataset for contradictory cases in configurations in order to explore differences in outcome, which were not apparent from the QCA 'truth table'.

Table 3: QCA 'Truth Table': Individual participant characteristics associated with health improvement or non-improvement

Configuration	Age	Sex	Primary Health Problem	Skill	Talk to Neighbours	Number of Cases	Consistency
1	1	0	1	0	1	8	0.75
2	1	1	1	0	1	7	0.86
3	1	1	1	1	1	5	0.8
4	0	1	1	1	0	4	0.75
5	0	1	0	1	1	4	0.75
6	1	0	1	1	1	4	0.75
7	0	0	1	1	1	3	1
8	0	1	0	0	1	3	1
9	1	0	0	0	1	3	1
10	0	1	1	0	1	2	1
11	0	1	1	0	0	2	1
12	1	0	0	1	1	2	1
13	1	1	0	1	0	2	1
14	0	0	1	1	0	1	1
15	0	1	0	1	0	1	1
16	1	0	1	0	0	4	0.25
17	0	0	1	0	1	3	0
18	0	1	0	0	0	3	0
19	0	0	0	0	0	2	0
20	1	1	0	0	1	2	0
21	1	1	0	0	0	2	0
22	0	0	0	1	1	1	0
23	0	0	0	1	0	1	0
24	0	0	0	0	1	5	0.4
25	0	0	1	0	0	3	0.67
26	0	1	1	1	1	3	0.67
27	1	0	0	0	0	3	0.67
28	1	1	1	1	0	3	0.67
29	1	0	1	1	0	2	0.5
30	1	1	1	0	0	2	0.5

Key

Age	1: 49 years and under
	0: more than 49 years old.
Sex	1: male.
	0: female.
Primary Health Problem	1: Non-musculo skeletal
	0: Musculo-skeletal
Skill	1: skilled manual or higher
	0: semi-skilled or unskilled
Talk to neighbours	1: 'other'
	0: talk to neighbours weekly
Consistency	0.75 - 1.0 health improvement
	0.25 – 0.74 contradiction
	0 to 0.24 no health improvement