A systemic approach to multi-agency community safety

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Abstract

In this paper we examine a multi-paradigm systemic approach to multi-agency community safety. A detailed case study was undertaken of a multi-agency partnership involving a fire and rescue service, a local council, an NHS primary care trust and a police force in the North West region of the UK. The community safety project studied was funded by the UK Department of Communities and Local Government over an eighteen month period. The multi-paradigm approach used was beneficial for understanding the nature of community safety, and its application in actual practice. The project involved the development of a novel customer segmentation approach based upon combined fire risk, health risk, social care risk, and crime risk to support identification of at-risk social groups in order to enable more targeted and co-ordinated provision of preventative measures for community safety by the public sector agencies involved.

Introduction

Public sector organizations can benefit from a detailed understanding of the characteristics of the different at-risk groups of residents that they serve. In this paper, we examine a multi-paradigm systemic approach to multi-agency community safety for at-risk elements of society in the North West region of the UK. An eighteen month customer insight project funded by the UK Department of Communities and Local Government was examined that involved a fire and rescue service, an NHS primary care trust, a local council and a police force. The project involved analysis of fire risks, health risks, social care risks and crime risks for the local community and the development of a customer segmentation approach to model these risks. This supported the identification of population segments representing different levels of related risks for local residents. The project also involved the development of appropriate mechanisms for data sharing, advocacy and referral services between the collaborating partners. The aims of the project were to enhance inter-agency communication and co-operation, and to enable more targeted and co-ordinated provision of preventative measures for at risk groups.

The community safety project studied aimed to enhance the understanding of the needs of at-risk residents that require co-ordinated support from a variety of government agencies within the region studied. The research project examined the utilization of multiple systems paradigms. Initially, soft systems methodology (Checkland, 1972; Checkland, 1981; Checkland, 1990) was utilized in order to appreciate the perspectives and issues involved in multi-agency community safety. The results of the soft systems analysis were used to develop a statistical model of customer segmentation based upon combined fire risk, health risk, social care risk and crime risk within the region studied by identifying

the characteristics of community safety for which measurable data could be obtained. A hard systems approach was used to develop a geographical information system for community safety that incorporated the developed statistical customer segmentation model. Delivery of community safety initiatives were targeted towards at risk individuals as per the outputs from the bespoke geographical information system.

The aim of the research reported in this paper was to demonstrate the potential value of adopting a multi-methodology systemic approach (Avison et al, 1998; Wood-Harper and Wood, 2005) for community safety and make service delivery improvements to such. The authors had an established relationship with the public sector organizations studied.

Overall, the community safety project aimed to ensure that data gathered concerning specific at-risk individuals and geographical areas was effectively processed, analyzed and disseminated to assist with the identification of vulnerable communities. Another aim of the project was to build the partnership between the fire and rescue service, local authority, NHS primary care trust, and police force to allow for improved data sharing supporting the identification of vulnerable communities. A customer segmentation approach was developed to identify these vulnerable communities. In particular, this approach focused on enhancing the understanding of links between fire risks, health risks, social care risks and crime risks. The outputs from this approach were used to provide a more joined up delivery of initiatives towards at risk communities and individuals by the partnership agencies involved. The customer segmentation model was developed using k-means cluster analysis (Clatworthy et al, 2005; Barnes et al, 2005) using the SPSS (SPSS, 2013) statistical software package.

Data sharing agreements were developed to support sharing of information between partner agencies in relation to identifying at risk or vulnerable communities. A bespoke geographical information system incorporating this information was developed to support the use of the information for targeted service delivery. This supported advocacy services and referrals between partner organisations as part of a programme of multi-agency joined-up working. The interpretivist soft systems methodology combined with statistical modelling was applied in order to move from a theoretical model of community safety to a realistic action plan.

This is an important research topic since current budget constraints in the public sector makes it increasing necessary to ensure vital services and initiatives are delivered to communities and residents that require them most. In particular, a model combining fire risk, health risk, social care risk and crime risk presents the opportunity for multiple public sector agencies to join-up and improve service delivery. The originality of the research reported in this paper is the development of a multi-paradigm approach to multi-agency community safety via analysis of combined fire risks, health risks, social care risks and crime risks. The utilization of this approach for joined up multi-agency partnerships supports more effective and efficient targeting of preventative measures to at-risk communities and individuals.

Literature review

Using customer insight to analyze community safety needs

Customer insight can be defined as the use of multiple informational sources about customers (Bailey et al, 2009). Analysis of customer characteristics via multiple sources of information has commonly been used by marketing departments within commercial organizations for some time previously (Jarratt and Fayed, 2012; Bailey et al, 2009; Dibb and Simkin, 2009). However, only recently has customer insight been utilised by some public sector bodies (Ballard and Radley, 2009; Thorpe et al, 2008; Bracey, 2010).

Customer insight in the context of the public sector concerns using multiple sources of information to aid understanding of the needs of 'customers' of public services, in particular in terms of understanding the types of need, and the levels of need of different groups of individuals (IDeA, 2013). Customer insight can be used to inform more targeted provision of public services, especially in the area of community safety, enabling delivery of an appropriate level of service to those most in need (IDeA, 2013; Experian, 2013). Customer insight can also be used to attempt to understand the characteristics of different groups of individuals who have needs relating to the provision of services by a number of different public sector agencies (Trevor and Kilduff, 2012). For example, in terms of community safety for specific social groups, elderly, disabled individuals on a low income might require services from a number of different public sector agencies.

The reduction in public expenditure currently occurring in numerous countries implies that public sector bodies may need to target reduced resources in more effective ways (Stuckler et al, 2010). Ryan and Walsh (2004) commented that there is increasing pressure being placed on government agencies to act in a more collaborative, integrated manner. However, one particular aspect of community safety via multi-agency partnerships is the difficulty in communicating information about risks to the public (Visschers et al, 2009). Greasley et al (2008) and Liddle (2009) commented that, while there can be clear benefits of public sector partnerships working, achieving successful collaboration is not straightforward.

Improving community safety

Although community safety initiatives have been undertaken by a variety of individual government agencies representing emergency services, healthcare and social care previously (Minicardi et al, 2009; Zhou and Liu, 2012; Mulvaney et al, 2008; Zhang et al, 2006, Holborn et al, 2003; Diekman et al, 2008, Balakrishnan et al, 2009; Sarna et al, 2008; Broadhurst et al, 2010) the use of customer insight for multi-agency community safety is a newer area of research.

A soft systems approach (Checkland, 1972; Checkland, 1981; Checkland, 1990) could provide a 'problem situation' view of community safety, to support understanding of the nature of combined fire risk, health risk, social care risks and crime risks in order to improve preventative measures by the relevant agencies. Statistical modelling could be

useful to analyze socio-demographic indicators of combined fire risk, health risk, social care risks and crime risks that could be of value in targeting preventative measures.

Previous research had examined the benefits of utilizing a multi-methodology approach for systems development (Wood-Harper and Wood, 2005; Avison et al, 1998) and utilizing multiple paradigms (Paucar-Caceres, 2009; Pahl-Wostl, 2006). A multi-paradigm approach includes the potential for the development of performance indicators from a data centric positivist view, which can act as a form of alternative world view to the soft systems analysis.

The originality of the research reported in this paper is the use of a systemic approach combining soft systems methodology with scientific statistical modelling for community safety by a multi-agency partnership. The research involved the development of a novel multi-agency customer segmentation approach for combined fire risks, health risks, social care risks, and crime risks. The research then examined the use of the customer segmentation model for a more targeted and joined-up provision of preventative measures by the multi-agency partnership. This is an important area of research since with current budget constraints for public sector services, it is necessary to improve operational efficiency and effectiveness through targeted and co-ordinated provision of preventative measures.

Research method

The case study research method (Yin, 2009) was used for the research reported in this paper. The case study research method was used as it allowed an in-depth examination of the use of a multi-paradigm systemic approach combining interpretivist soft systems approaches with statistical modeling. The process of using this statistical model for customer insight supports community safety activities in practice within the public sector organizations involved. An eighteen month case study of a community safety project funded by the UK Department for Communities and Local Government involving a UK fire and rescue service, an NHS primary care trust, a local council, and a police force was undertaken between 2010 and 2012.

The research techniques used included interviews, discussions and workshops with staff in a fire and rescue service, local council, NHS primary care trust and a police force as well as statistical modelling, including k-means clustering. A rich picture for community safety via customer insight was developed from initial discussions with staff from the agency involved. This was used for further discussion and evaluation by those staff. Overall, the research methodology aimed to provide answers to the research questions by providing a framework for using a combination of interpretivist soft systems approaches with statistical modelling for analyzing community safety via customer insight and informing preventative community safety activities.

The research questions covered by the research reported in this paper were:

- How can customer insight be used for multi-agency community safety?

- How can customer insight be used for multi-agency community safety?

- How can risk factors associated with community safety be measured and analyzed via customer insight?

- How can identified community safety risks be managed by multi-agency public sector partnerships via customer insight?

These research questions are important since the current reduction of public sector expenditure in numerous countries implies that more effective and efficient means of public sector resource utilization are required. Use of a multi-paradigm systemic approach can provide a basis for a more thorough understanding of the nature of community safety in the context of a multi-agency partnership. Use of statistical customer insight models by public sector agency partnerships can improve the identification of the community safety risks associated with different social groups, which supports more accurate targeting of lower cost, early intervention preventative initiatives for community safety.

The research method involved the examination of a multi-paradigm systemic approach that combined both interpretivist soft systems approaches with statistical modelling. Initially an interpretivist soft systems approach was used to identify and analyze the factors relevant to community safety. An interpretivist approach seeks to interpret a given situation by considering the qualitative social and organizational issues and different perspectives involved. The research method involved a paradigm shift in order to utilize the interpretivist analyses from the use of soft systems methodology for a positivist statistical modelling approach (k-means clustering) in order to provide an appropriate customer segmentation model for community safety. Areas of social research may benefit from an initial understanding of the problem situation before detailed and systematic scientific investigation commences.

The authors were involved in utilizing an interpretivist approach based upon soft systems methodology to provide an overview of the nature of community safety in the context of a multi-agency partnership which helped to identify the issues involved in such. The interpretivist approach could not however determine how significant such community safety issues were, and how widespread these might be amongst the population in the region studied. The authors were then involved in utilizing a positivist statistical modeling approach to determine the availability of community safety data. The community safety variables for which measurable data could be obtained were analyzed using k-means clustering, resulting in a customer segmentation model. The originality of the research reported in this paper concerns the combination of soft systems approaches with statistical modelling approaches that were implemented in a geographical information systems for community safety via customer insight.

The actual research techniques utilized for the case study included interviews and discussions with management and operational staff in the partner organizations. A wide

variety of staff in the partner organizations involved in the community safety project were interviewed as described below.

Data collection

Data was collected via meetings and interviews with those staff involved in community safety within the organizations studied over an eighteen-month period between 2010 and 2012. These included an IT manager, a project manager, a data protection officer and 2 community fire safety officers within the fire and rescue service; 2 information analysts and 3 councilors from the local council; 2 information analysts from the NHS primary care trust; and a police community support officer from the local police force. The meetings typically lasted for around one hour. The meeting and interview notes were recorded on paper and then analysed. The interviews and meetings covered the reasons for adopting customer insight for community safety, the mechanisms for initiating customer insight, the community safety risk identification process via customer insight, risk measurement and analysis via customer insight, the development of the customer segmentation model, and the use of customer insight for community safety in practice.

Data analysis

The data collected was then content analysed by identifying themes within the meeting texts. For example, what would be involved with regard to community safety for each of the partner organizations, and what potential benefits were envisaged from using customer insight for community safety activities. This allowed an understanding of the issues associated with using customer insight for community safety in the context of a multi-agency partnership. In particular, this included the process of risk identification, risk measurement and analysis, the development of the statistical customer segmentation model for community safety as well as the application of the customer insight for community safety in practice.

The determination of the specific types of community safety risks was achieved by a series of meetings between staff from the partner organizations, and themes identified from content analysis of the meeting's minutes. The content analysis was performed by identifying occurrences of statements made by the participants relating to the research questions posed concerning risk, risk factors, community safety and customer insight. The content analysis together with the soft systems rich picture technique enabled an initial identification of four main community safety themes, namely: accidental fire risk, social care risk, health risk and crime risk. The content analysis together with a soft systems CATWOE analysis allowed a more detailed examination of specific instances of risk type stated by the participants in each of these four broad community safety themes.

A number of different datasets were collected for analysis; the datasets collected were related to the four main community safety themes identified via the soft systems and content analysis techniques. Some examples of the datasets collected were crime rates, accidental dwelling fires rates, emergency admissions to hospital and adult social care

users. The decision regarding which data to include in the cluster analysis was based upon consideration of co-linearity between the variables and the range of values of the data variables. It was important to check for co-linearity between the variables used for cluster analysis. Variables that had a high level of co-linearity (the Pearson Product Moment Correlation Coefficient greater than 0.8) were removed from the cluster analysis, otherwise such variables could have distorted the results. Binary data variables (for example, data with a yes or no value) and data variables with a small range of values were also removed, since such variables could also distort the results of the cluster analysis.

The statistical technique used to analyze the risk factor data to produce customer segments was k-means clustering, where k represents the number of means desired. The number of means (customer segments) chosen (ten) was determined from the operational needs of the partner organizations in terms of the number of customer segments appropriate for fire prevention, health interventions, social care support, and policing. The basic assumption underlying k-means cluster analysis is that there is a metric on the set of data points. It is required in order to be able to compute the mean values. For each of the community safety risk factor data variables available the metric or measure was either a percentage or number of citizens representing a particular characteristic within each output area within the region studied. An output area (OA, 2013) is a geographical area that forms part of the UK Office for National Statistics geographical hierarchy for UK statistics. The output area classification covers 175,434 output areas in England and Wales. The average number of households within each output area is 125. (OA, 2013)

The iterative approach used in k-means cluster analysis minimizes the squared error (the squared Euclidean distance between the cluster centres and the observations associated with them). The z scores of the values of the variables (the number of standard deviations that a value is above or below the mean) were used to standardise the variables prior to k-means cluster analysis in order to ensure that variables with the largest range did not unduly influence the analysis. This is in accordance with the concept of risk comparison as described by Fischhoff et al (1993) and Bostrom (2008). The k-means cluster analysis was performed using the SPSS (Statistical Package for the Social Sciences) statistical analysis software package (SPSS, 2013). The values of the data variables used for the generated clusters were visually analyzed using box plots.

Overall the case study approach was beneficial as it allowed an in depth examination of the processes involved in utilizing a multi-paradigm systemic approach for developing and utilizing customer insight for community safety by the multi-agency partnership. In addition the case study approach supported both a qualitative understanding of the perspectives of the different partner agencies and the technical, procedural and legal aspects of community safety by multi-agency partnerships. It also supported a quantitative understanding of how community safety risk factors can be statistically analysed via a customer insight approach, and the development of a statistical customer segmentation model. The main drawback to the case study approach utilized was potential limitations on the generalizability of the findings to other multi-agency partnerships.

Research results

Using a multi-paradigm systemic approach to analyze community safety

The authors were involved in a consultancy capacity involving the use of a multi-paradigm systemic approach for the analysis of community safety. The soft systems methodology was used to provide the initial interpretivist analysis of community safety comprising the different views from those concerned with community safety activities within the partner organizations studied. In order to develop a multi-agency community safety approach based upon combined fire risk, health risk, social care risk and crime risk, the community safety project initially involved the identification of types of community safety risk within the region studied of relevance to the partner organizations. This was enabled through the use of the rich picture technique within the soft systems methodology. This was done in order to determine the types of community safety risk that were of concern to the partner organizations and also to examine how such risks might overlap, and the associations between the different types of risk. A series of workshops involving representatives from the partner organizations then extended the analysis of the different perspectives and commonalities within community safety through the use of a CATWOE analysis. This detailed understanding of the problem situation from the perspectives of the different agencies within the partnership provided a basis for the determination of the nature of the data that would be required for statistical examination of the combined fire risks, health risks, social care risks and crime risks of interest to the partner agencies. The initial soft systems analysis also highlighted via the rich picture the potential difficulties that might occur, for example in terms of data acquisition and data sharing. Overall the soft systems analysis provided a thorough understanding of the overall purpose of the statistical analysis to be undertaken and the types of data that would be relevant for such statistical analysis.

Using customer insight for multi-agency community safety

The collection of relevant available risk factor data relating to the types of risk identified from the partner organizations and UK national organizations such as the UK Department for Work and Pensions and the Office of National Statistics was then undertaken. The risk factor data included 90 available datasets consisting of 130 data variables related to the identified risk types.

Data sharing agreements were created between the partner organizations in order to support the exchange of data relevant to the identified types of risk, and secure transfer of personal level data about at risk individuals was achieved via the AVCO (AVCO, 2013) secure data transfer system.

Analysis of risk factor data was undertaken by the knowledge management team within the fire and rescue service to determine which variables were appropriate for cluster analysis. Customer segments based upon combined fire risk, health risk, social care risk,

and crime risk factors were then created using k-means cluster analysis (using the CHAID approach) using the SPSS (SPSS, 2013) statistical package. Customer profiles descriptions were developed based upon the customer segments created. A customer insight geographical information system tool was created to display map based information relating to the customer segments. The staff representatives from the partner organizations agreed that this approach supported enhanced referral and advocacy services between the partner organizations.

The specific types of risk of concern to the project partners identified from the content analysis of the text of the customer insight project meetings notes included:

- Accidental dwelling fire risks (including fire injury, fire death, and damage to property, which is of concern to the fire and rescue service)

- Social care risks (including elderly care and care of the disabled, which is of concern to the local council and the NHS primary care trust)

- Health risks (including smoking related illnesses, alcohol consumption related illnesses, obesity related illnesses, and health risks associated with poor housing, which is of concern to the NHS primary care trust)

- Crime risks (including anti-social behaviour crimes, which is of concern to the police force)

The partner organizations were thus able to compare their types of risks of concern (Bostrom and Loftstedt, 2003) via 'mental models' (Bostrom, 2008) of the different risks under consideration and how these interacted. For example, the intelligence analysts from the fire and rescue service and the information analysts from the NHS primary care trust stated that smoking and alcohol consumption were associated with health and fire incidence risks. Representatives from the fire and rescue service and police force confirmed that high alcohol consumption was associated with fire incidence and crime risks. Both the local council and police representatives stated that those in need of social care were typically more at risk of crime.

Measuring and analyzing risk factors associated with community safety via customer insight

One of the main challenges when analyzing community safety was to attempt to understand in an interpretivist soft systems manner the nature of community safety. Such understanding could be used to inform the identification of socio-economic factors associated with community safety and their relative importance. The soft systems methodology provided the mechanisms for firstly identifying those factors pertinent to community safety, and the need for improved targeting of community safety activities via a rich picture (Figure 1).

Figure 1 here

The rich picture enabled an understanding of the perspectives of the different stakeholders involved (fire and rescue service, NHS primary care trust, local council, and police force), their differing concerns and operational procedures, and areas of potential conflict (such as data protection issues). The rich picture developed by the authors and the staff within the partner agencies assisted in identifying mechanisms for examining community safety and socio-economic factors associated with community safety. Once the factors pertinent to community safety and socio-economic factors associated with community safety had been identified via the rich picture, it was then necessary to refine and prioritise those factors. A root definition was created for the community safety system in order to more fully examine and describe the factors involved:

Root Definition for community safety:

A system to identify and reduce community safety risks by analyzing patterns of socio-economic factors to achieve a reduction in fire incidence, smoking and binge drinking rates, and social care problems within the constraints of budgeted resources.

A CATWOE analysis (Checkland, 1990; Checkland, 1981; Checkland, 1972) was performed in order to appreciate who would be involved in the project, what the project intended to achieve, and the environment in which the project would take place.

Clients	Local citizens
Actors	Fire and rescue service, NHS PCT, local authority, and police staff
Transformation	Shared data relating to vulnerable individuals and social groups and targeted and co-ordinated preventative measures for those most at-risk results in improved delivery of services.
Weltanschauung	The current economic climate means that each partner agency needs to refine how services are targeted to the citizens who require them most, in order to reduce costs.
Owner	Fire and rescue service
Environment	Reduced funding to public sector services, maintain provision of services to high risk or vulnerable groups.

This proved useful in terms of understanding the nature of the risks to be assessed, and the overall purpose of the community safety project from the perspectives of the different partner organizations.

Community safety risk measurement and analysis via customer insight

Soft systems methodology (Checkland, 1990; Checkland, 1981; Checkland, 1972) was used to provide insight into the complex community safety problem situation, which involved analysis of a variety of risks to local residents from the perspectives of a variety of public sector agencies (Figure 1.). From this qualitative analysis it was then possible to move to a more data centred statistical basis for examining the risk factors associated with the different types of community safety risk of relevance to the partner organizations in the region studied. This involved a move from a soft systems (human centred) paradigm (Checkland, 1990; Checkland, 1981; Checkland, 1972) to a hard systems (scientific, statistical) paradigm. The hard systems paradigm was then used to undertake statistical analysis of customer data (via k-means clustering) to provide customer segments and customer profiles, and to develop practicable data sharing mechanisms and a geographical information system that could provide usable customer insight information to the partner organizations. This assisted with the management of resources within the partner organizations in a co-ordinated manner, in order to support more targeted and co-ordinated provision of resources for the identified at-risk members of the community. The statistical modeling undertaken was a means of understanding the dimensions of risk as described by Fischhoff et al (1993).

The data for customer insight analysis that was available within the region studied included 90 datasets consisting of 130 data variables. The types of customer data available included:

- Benefit Claimants
- Communication Preferences
- Community Safety
- Deprivation
- Disability
- Health
- Housing
- Population Demographics
- Sporting Participation and Preferences

All of the data variables identified could be used to help identify the types of risks of concern to the project partners. However, after analysis of all the datasets identified, the following were selected to be 'fit for purpose' for use within a k-means cluster analysis.

- Disability Living Allowance Claimants
- Child Benefit Claimants
- Residents living in converted flats
- Middle rate care (Disability Living Allowance)
- Age group
- Social Grade
- Pension Claimants aged 80+
- Life Expectancy
- High rate care (Disability Living Allowance)

- Mobility nil rate (Disability Living Allowance)
- Crime level
- Revenue & Benefits Claimants
- Adult Social Care Service Claimants

These variables were unique variables that resulted in a number of bespoke customer segments. The remaining data variables were matched against the segments to build the detailed community profiles.

When the customer segments had been generated by using the k-means clustering approach, it was then necessary to develop profiles for the customer segments. This was achieved by banding the characteristics represented by the variables used for k-means clustering (and other available variables), into high, medium and low classifications. This was done from an operational perspective of the partner agencies involved in the project. From this a set of profiles for the ten customer segments was developed. To provide structure, the profile groups were ranked from least to most deprived. The ten community profiles generated were:

1. Wealthy over 50 population living in semi-rural locations
2. Older retirees
3. Middle income residents living in privately owned properties
4. Average income older residents
5. Students living in city centre locations
6. Young families
7. Young families with high benefit need
8. Residents living in social housing with high need for benefits
9. Transient population living in poor quality housing
10. Younger, urban population living in high levels of deprivation.

The customer segments generated by the cluster analysis appeared to present clear differences in terms of high, medium or low levels of accidental dwelling fire risk (Taylor et al, 2011), fuel poverty risk (FPS, 2013), smoking risk (SR, 2013), and body mass index risk (BMI, 2013). A detailed profile description document was created utilizing all 130 data variables highlighting the risks and needs present for that customer segment. For example, this could relate to an elderly population, deprivation, benefit need and poor housing. This assisted in making the customer segments developed more accessible to a wider audience within the partner organizations for targeting specific initiatives to the community.

The community profiles were used to perform an analysis of the risks relating to the different community profiles. Table 1 below shows the accidental dwelling fires, injuries and deaths associated with the different community profile groups over a the three years

between 2010/11 and 2012/13. Prior to utilizing this methodology, high rates of accidental dwelling fires were associated with areas of high deprivation, However, utilizing customer insight shows that accidental dwelling fires, and in particular associated fatalities can occur in areas of lower deprivation (e.g. profile group 3). Applying customer insight can ensure interventions appropriate to the profile group are applied.

Profile Group	ADFs	ADFs (%)	Injuries	Injuries (%)	Fatalities	Fatalities (%)
1. Wealthy over 50 population living in semi-rural locations	286	7.45	25	6.61	1	4.17
2. Older retirees	165	4.30	24	6.35	1	4.17
3. Middle income residents living in privately owned properties	467	12.16	46	12.17	8	33.33
4. Average income older residents	313	8.15	29	7.67	1	4.17
5. Students living in city centre locations	109	2.84	5	1.32	0	0.00
6. Young families	386	10.05	44	11.64	1	4.17
7. Young families with high benefit need	729	18.98	70	18.52	5	20.83
8. Residents living in social housing with high need for benefits	335	8.72	30	7.94	0	0.00
9. Transient population living in poor quality housing	229	5.96	31	8.20	1	4.17
10. Younger, urban population living in high levels of deprivation	822	21.40	74	19.58	6	25.00

Table 1 Accidental dwelling fires, fire injuries and fires deaths associated with the different community profile groups.
Managing community safety risks by multi-agency public sector partnerships via customer insight

In order to utilize customer insight for community safety management it was necessary to identify the types of community safety risks of concern to the multi-agency partnership. Then the available data relating to such risks were analyzed to appreciate how segments of the population (the customer segments) differed in terms of the level of different types of risk. A geographical information system was developed using the MAPINFO (MAPINFO, 2013) geographical information systems software development tool to identify where the different customer segments were located within the region studied. This resulted in a community profile map, mapped to output area level (OA, 2013), where each output area covers approximately 300 residents. This aimed to assist in the co-ordinated targeting of resources by the agencies within the partnership to specific customer segments.

The next activity was to identify how data gathered by the partner organizations relating to individuals and households within the region could be captured and shared between the partnership agencies to reduce duplication of data capture effort. The AVCO data sharing system (AVCO, 2013) was used as the preferred secure data sharing mechanism between the partner organizations. The fire and rescue service studied routinely performed home fire service checks (HFSC, 2013). During such home fire safety checks it was possible to capture data that could not only inform fire prevention activities, but also support preventative measures relating to partner organizations through appropriate advocacy services, such as smoking cessation, alcohol management and remedial housing services.

A fire and rescue service advocate home visit within the region costs approximately £50 per visit. Advocacy staff will typically spend up to 90 minutes with the resident discussing their needs. The advocacy staff can signpost the resident onto relevant partner organizations who may be able to provide additional help and support. Examples of the identified costs and benefits of the types of interventions enabled by the customer insight project via home fire safety checks included:

Elderly falls interventions

An elderly fall at home costs approximately £2,500 to the NHS (Falls, 2013). Remedial work at home as a result of an advocacy visit might cost approximately £700 (this might include fitting of a handrail on the stairs, or suitably accessible facilities in the bathroom). In the region studied there were roughly 5000 elderly falls each year, so the potential avoided costs could be significant. A hip fracture as a result of an elderly fall might cost in the region of £4,000 to the NHS (HIP, 2013). The cost would increase if additional care at home was required for the elderly person. An additional benefit to pro-active remedial work at home would be the resident feeling safer and more independent in their own home.

Smoking cessation interventions

Smoking related lung cancer treatment costs in the region of £15,000 per patient to the NHS. Smoking cessation services (NICE, 2013) that include counsellor support and nicotine replacement therapy costs approximately £160 for 12 weeks per individual. 55% of residents in the region studied had successfully quit smoking in the 12 week period of their smoking cessation intervention. Additional benefits of pro-active smoking cessation intervention would be the individual not suffering from other illnesses associated with smoking, and the cessation (or at least reduction) of passive smoking for other residents in the same property.

Specific recorded examples of interventions undertaken by fire and rescue service staff home fire safety checks as part of the customer insight project included:

• Single parent, health problems (some caused by damp in property), advice given on stop smoking services. Antisocial behaviour around the property reported to Police.

Problems with property (including damp, loose tiles on roof, security problems with front door) referred to housing services.

- Property very poor condition referred to Homestart. 2 young children. Partner has Chronic Obstructive Pulmonary Disease (COPD) and on oxygen. Trip hazards and cluttered, untidy house. Concerns from advocate about whether the occupant can cope with pressures of looking after an ill partner, two young children and looking after a household.

- Accommodation Unsuitable for Occupier, Referred to POPIN, Age UK, Energy Projects Plus and Housing Services. Antisocial behaviour problems reported.

- No smoke alarms. Two smokers, property poor condition, liaised with Local Partnership Homes. Tripping hazards in upstairs hallway. Advised of NHS Stop Smoking Scheme. Resident with mobility problems.

- Single, elderly resident. Occupier has mobility difficulties, managing well. Damp in property. Referral to Housing Services.

In terms of the operational usefulness of the customer insight project from the perspective of those involved in the actual implementation of the project in the community, one of the advocates involved in the customer insight project stated that: "Although the resident may not be classified as high risk at the moment, they could have the potential to become high risk based on their circumstances. This demonstrates the need for a methodology that can identify risks earlier."

One of the community safety officers engaged with the project concluded: "The customer insight data led us to people who did not have smoke alarms, they were lower risk of fire at the moment, but probably would not have made contact and requested a Home Fire Safety Check themselves"

In this manner, the knowledge from the different customer segments and the information regarding their geographic distribution could be pro-actively utilized to initiate interventions that enabled medium and long term cost reductions for the partner agencies in health and social care, as well as improving the quality of life and independence for citizens within the region.

An example of the importance of regular information sharing between the partners was highlighted by a community fire prevention officer: "In December 2008 a Home Fire Safety Check was conducted at a property and it was classified as low risk. However, in October 2011 there was a fire in the property and the owner set alight to his clothes whilst using a gas hob. The investigation identified that the man had developed dementia in the intervening time. If the fire and rescue service had known this, through accurate and regularly updated information from partners, then an isolation valve could have been fitted easily and cheaply to the hob and the incident prevented."

Conclusions

In this paper, we have examined the process of utilizing a multi-paradigm approach that combines both interpretivist soft systems approaches and statistical modelling for community safety and the implementation of the results of the analysis in a geographic information system for assisting with community safety in a region of the UK. The use of soft systems methodology techniques proved beneficial for assisting in the analysis of community safety activities, the socio-economic factors associated with community safety, and the design of a geographic information system for community safety support. In particular, the rich picture developed was useful for identifying the nature of community safety activities, and socio-economic factors associated with community safety risks, from the differing perspectives of the agencies involved in the partnership. The CATWOE analyses provided a basis from which to develop a statistical model for customer segmentation to identify at-risk social groups. Overall, the combination of an interpretivist soft systems approach with a statistical modelling approach proved beneficial in terms of appreciating the nature of community safety activities; and using this understanding to inform and support statistical modelling that could then be used to provide a basis for informed decision making by the partner agencies.

Currently in the UK, the reduction in public sector budgets is necessitating improved management of public service provision. One approach to improving the management of public service provision can be the ability to identify those in greatest need, or those at most risk within communities, and to target the reduced resources accordingly via a co-ordinated approach by partner public sector agencies. The multi-paradigm approach examined in this paper enabled a thorough understanding of how risk identification and risk management can be achieved in a multi-agency partnership. The soft systems approach enabled a deeper understanding of the context of multi-agency risk management, which was complemented by quantitative statistical analysis to identify in a scientific manner the at-risk groups within the community most in need of preventative measures. Cost reductions may be achievable via improved data sharing and reduced duplication of effort between public sector bodies. Also, more effective use of pro-active preventative measures can potentially reduce medium and longer term costs for public sector agencies. The novel multi-agency customer segmentation approach based upon combined fire risks, health risks, social care risks, and crime risks enabled the identification of at-risk social groups and individuals within the region. This supported more targeted and co-ordinated preventative community safety measures by the partner agencies.

This research has extended the theoretical knowledge base in the area of community safety, and demonstrated how combined multi-agency community safety risk management can work to the benefit of the partner agencies and the communities that they serve. It is hoped that the results of the community safety via customer insight research reported in this paper, funded by the UK Department for Communities and Local Government may be of benefit to other public sector bodies both in the UK and elsewhere.

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