

**Neighbourhood Social Fragmentation and Health.
Bringing Social Epidemiology and Social Theory Together.**

Vivienne C. Ivory

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Abstract

The relationship between place and health has long proved to be intuitively appealing, but also frustratingly difficult to unpack. An example can be seen in the body of work investigating relationships between ‘social fragmentation’ of the neighbourhood and health. Mixed findings and varied interpretations of ‘social fragmentation’ have made it difficult to explain why the current measures of the construct might be associated (or not) with health outcomes. The issues raised within this body of work reflect many of the ongoing challenges faced by both the Neighbourhood and Health and Social Epidemiology fields.

The goal of this thesis is to better understand why and how social fragmentation might be related to health in New Zealand. Taking the lead from recent literature the research presented here attempts to move beyond a ‘risk factor’ approach, primarily by driving the analytical process with clear conceptual development.

An Index of Neighbourhood Social Fragmentation (NeighFrag) was created using New Zealand national census data that operationalized a conceptual model of neighbourhood collectivity. Further understanding of the Index was developed by returning to Durkheim’s original theses on social groups. From this reading NeighFrag was defined as representing different types of neighbourhood-based social groups. It was hypothesized that NeighFrag would be related to health through varying levels of integration and regulation, and the transmission of health-related social practices.

Accordingly, multilevel analytical techniques were used to examine the contribution of NeighFrag to two individual health outcomes: mental health and youth smoking.

Mental Health: Increasing levels of neighbourhood fragmentation were shown to be associated with poorer mental health in urban women using the 2002-03 New Zealand Health Survey, after adjusting for neighbourhood deprivation and individual factors. There was no association for men. Other individual factors also appeared to be important modifiers of the effect of fragmentation, but the scope to examine cross-level effect modification was limited.

Youth smoking: Using 1996 census data that included a smoking question, there was strong evidence that neighbourhood fragmentation and adult (25-64 year old) smoking prevalence interacted in the prediction of individual youth (15-24 year old) risk of smoking. That is, adult smoking prevalence was a stronger predictor of youth smoking among highly fragmented neighbourhoods. However, the direction of this interaction suggested that the transmission of smoking was greater in these settings, contrary to that hypothesized and prompted further examination of the theory, construct and the data.

The primary, health-related implication of this thesis is that neighbourhood social properties appear to be an important factor in understanding mental health variation in the New Zealand population. The results presented here suggest that the neighbourhood may be an important social resource for individuals, but also that the means of investigating finer mechanisms are limited with the current epidemiological tools. The thesis has presented a model of how clear conceptual models can drive insightful analyses, aiding decisions about what to measure and how to interpret the results, thereby better illuminating the black box.

Preface

Acknowledgments

To my husband Andrew, and children Conor and Joseph, in the words of K.T. Tunstall, you “...throw me a rope to hold me in place, show me a clock for counting my days down.” I cannot thank you enough for your love, belief, and support.

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List of Abbreviations

| | |
|--------|----------------------------------|
| CAU | Census Area Unit |
| NZDep | New Zealand index of Deprivation |
| SoCInd | Social Capital Index |

Chapter 1

Investigating Neighbourhood Social Fragmentation and Health in New Zealand

Why do researchers continue to examine the complex relationship between where we live and our health? Perhaps because the anecdotal, commonsense and intuitive reasoning is so strong (Dorling, 2004, p. 792, Oakes, 2006, Roosa et al., 2003). Observed spatial variations in health have long been of interest to researchers (Durkheim, 1951, Pearce et al., 2006). Understanding what it is about places that might be important in explaining such variations remains an ongoing challenge to health researchers.

There has been a revitalized interest in the 'neighbourhood' in recent times (Whitehead, 2003). Disciplines such as epidemiology have seen a shift back from looking purely at individual factors to a more ecological approach that seeks to take into account the context of individual lives. In part the return to the public health origins of epidemiology has been attributed to a failure to fully account for patterns of disease by only measuring individual characteristics (Frohlich 2001). But it is also perhaps a growing awareness that individuals live their lives in contexts, and to fail to take that into account when trying to understand disease processes is at best naïve (Schwartz et al., 1999).

The study of neighbourhoods and health is characterized by its inter disciplinary nature. Social epidemiology is a comparatively recent entrant to the current research field, despite the contextual origins of epidemiology as a discipline. Social epidemiology is concerned with measuring the underlying social factors that might potentially be explaining variation in health outcomes across populations (Rothman and Greenland, 1998). It seeks to go beyond simply describing variation to explore

the relationship between individuals and society; "...that which makes social epidemiology distinct: a focus on the fundamental and dynamic tension between individuals and groups (i.e. the social) and how it ultimately affects health." (Oakes, 2008). While social epidemiology seeks to acknowledge and investigate complex relationships, it does so by examining and quantifying variations of outcomes by variations to exposures. Epidemiology therefore has the framework and the means of empirically measuring variation using the data sources available to this study (Bhopal, 2002).

The Neighbourhoods and Health research field brings together the spatial patterning of health with the public health / social epidemiology focus on context. Over recent years the field has attempted to examine how specific properties of 'neighbourhoods', or residential context, might be related to health outcomes of individuals. Certainly there seems to be some evidence that material, social and physical properties of the local environment are related or are predictive of the health of residents, but the specific findings remain mixed and the pathways debated (Mair et al., 2008, Macintyre et al., 2002).

One of the difficulties faced when assessing the evidence is that the conceptualisation of the neighbourhood / health relationship and the methodology used to examine it have been both disparate and widely disputed. It is therefore perhaps not surprising that the research field has a somewhat mixed performance when the evidence base is considered. At times it would seem that for every methodological advance there are new biases revealed and further limitations to the interpretations that can be made. Perhaps the persistence of the research field reflects the research community's conviction that there is a relationship of some sort, it is just that we need to get better at observing it. In some ways it is the sheer difficulty of the task which makes the field so engaging. But it is also because researchers are also aware of the potential to

affect many lives through their lived environment, and that such research is therefore worth the effort.

As will be discussed in the following chapter a persistent call in the literature has been the need for 'illuminating' research (Macintyre et al., 2002). That is, research that is based on a clear theoretical foundation to drive the definition and measurement of neighbourhood properties, and the pathways between neighbourhood and individual health (Cummins et al., 2007, Diez Roux, 2007, Kawachi and Subramanian, 2007, Macintyre et al., 2002). There also seems to be increasing recognition that single methods or disciplinary approaches may be insufficient to investigate such complex causal questions.

Within the broader Neighbourhood and Health research field there is a developing body of work that investigates the relationship between a social property of the neighbourhood, generally referred to as 'social fragmentation', and health. The origins of the term 'social fragmentation' can be found in the work of Durkheim, considered by many to be the 'father' of epidemiology and sociology (Syme, 2000, Emirbayer, 2002). In more recent epidemiological research the primary focus has been on a four variable small area measure known as the Congdon index (Congdon, 1996b). As will be discussed in the following chapter, the index was created to examine the spatial variation of suicide in London and has subsequently been used with a number of health outcomes internationally. Generally speaking, the social fragmentation measure was a stronger factor than deprivation in explaining small area variations for mental rather than physical health outcomes (Congdon, 1996b, Congdon, 2004a, Evans et al., 2004, Middleton et al., 2004, Smith et al., 2001, Whitley et al., 1999, Stjarne et al., 2004).

However, the findings were less conclusive when morbidity outcomes such as deliberate self-harm or psychiatric admissions were examined. While the Congdon

index was generally a risk factor for deliberate self-harm, deprivation appeared to be a stronger factor (Congdon, 1996b, Congdon, 2004a, Gunnell et al., 2000). More positive associations have been observed when the outcome was psychiatric hospital admissions, although there was some evidence that any associations may be specific to factors such as gender, the specific psychiatric disorder and the setting (Allardyce et al., 2005, Curtis et al., 2006, Evans et al., 2004).

Recent conceptual and methodological advances have allowed a shift in focus in away from ecological analyses to multilevel analyse that examine both neighbourhood-level properties such as fragmentation and individual-level outcomes and characteristics simultaneously. Initial results from multilevel suicide analyses suggest that the ecological association between suicide and the Congdon index may be explained by individual factors (O'Reilly et al., 2008). Other multilevel studies have used survey data rather than routine records to measure mental health outcomes such as psychological stress, again with somewhat mixed findings (Fagg et al., 2006, Fagg et al., 2008).

The contradictory findings and varied interpretations of the construct of 'social fragmentation' have made it difficult to explain why the current measures of the construct might be associated (or not) with health. As will be demonstrated in the following chapters defining what is understood by the term 'social fragmentation' at the neighbourhood level has proved to be problematic, and an important goal of the thesis has been to come to a clearer understanding of what it can mean at the neighbourhood level. At its simplest, 'social fragmentation' can be seen as referring to the social organization or structure of a neighbourhood, where a highly fragmented neighbourhood will have an impact on the levels of social connections within the neighbourhood and between residents, with potential consequences for the quality of the social 'life' of the neighbourhood and its residents.

Neighbourhood-level social fragmentation has therefore provided an engaging and challenging case study of issues in the wider Neighbourhoods and Health research field. The overarching research question presented in this thesis seeks to ask not only if social fragmentation is related to health, but why and how such relationships might plausibly exist. There are four components to this thesis, each forming a specific research question.

1. *What is neighbourhood-level social fragmentation, both conceptually and empirically?*

Here the emphasis is on developing an understanding of what can (and also cannot) be measured with the available data. The result is a theoretically grounded measure of neighbourhood-level social fragmentation, labelled the Neighbourhood Social Fragmentation index (NeighFrag).

2. *What are the theoretical pathways between the NeighFrag index and health outcomes?*

Returning to Durkheim's original work the thesis asks how the types of neighbourhoods captured by the index might be plausibly related to the specific health outcomes of individuals. A theory of neighbourhoods as social groups was developed that provided two potential mechanisms by which NeighFrag could be related to health outcomes.

3. *Can those pathways be empirically observed using epidemiological analyses?*

Specifically, the thesis asks what about the nature of the association between the NeighFrag index and two outcomes, mental health and smoking. A second subsidiary question examines the extent to which those associations provide support for the pathways proposed by my interpretation of Durkheim's original theories on social groups.

While each of the above questions is able to stand alone as a contribution to the field, their real value lies in the synthesis of the three. Throughout the process of study

there was a constant interplay between the data and theory with each driving the other. Importantly, each component was an incentive for the others; the analyses were conducted to better understand the mechanisms; the mechanisms were a means of understanding the index; and both the index and the mechanisms were means of making sense of the empirical relationships observed in the analyses.

There is a fourth important component to the thesis that acts as an underlying theme for the whole thesis. The challenge laid down in the review of the issues facing the Neighbourhoods and Health field is to do research that illuminates the complex relationship. The final research question is therefore:

4. *Does the integration of theory and data attempted here shed some useful light on why where we live might matter for our health?*

In other words the aim is not so much to definitively examine whether there is a causal relationship between social fragmentation and health, but to develop a valid means of soundly investigating a relationship within the constraining parameters. Only then can the empirical evidence be interpreted and conclusions drawn.

1.1 Thesis Parameters

The parameters of the thesis provided useful limits on what could be undertaken in the course of study. The work has been undertaken in the context of a Neighbourhoods and Health research project that is part of a wider Health Inequalities Research Programme (HIRP) in New Zealand. HIRP is a multidisciplinary group of research projects that seeks to investigate the social determinants, and the determinants of the determinants, of health inequalities in New Zealand.

The Neighbourhoods and Health Research Project created national measures of neighbourhood characteristics in order to quantitatively investigate their relationship with health. There was a strong emphasis on creating theoretically valid measures

rather than relying on 'off the shelf' measures, but also to use routinely available data as effectively as possible. The project went on to examine so-called 'multilevel' relationship between contextual characteristics and individual characteristics and health outcomes.

The research project has specifically developed two new neighbourhood measures, the PhD component of the research project being 'social fragmentation'. A national index was to be developed using individual census questions and with specific statistical methods (details below). The second measure, the Community Resource Access Index (New Zealand) (CRAINZ) was created by Pearce, Witten and colleagues. It used nationally available secondary data sources to map locational access to health-related community resources such as recreational facilities, pharmacies, fast food outlets, and so on (Pearce et al., 2006).

The new indices were used in conjunction with two other neighbourhood measures, SoCInd and NZDep. SoCInd is a proxy measure of social capital, previously developed by Howden-Chapman and colleagues (Blakely et al., 2006). This measure used data from the New Zealand 1996 national census to measure neighbourhood rates of volunteering behaviours, a proxy measure of neighbourhood-level social capital. NZDep is a measure of neighbourhood deprivation developed by Salmond and Crampton (Salmond et al., 1998) using the same methods that were to be used for NeighFrag.

An advantage of undertaking a thesis in a multidisciplinary project such as this is the access to expertise of fellow researchers. An example of this was the NeighFrag index which was created by a team, including June Atkinson (data manager), Clare Salmond (biostatistician) and myself. With respect to the work presented in Chapter Three 3, I was responsible for the conceptual foundation of the index and subsequent selection of the variables to be tested, and the interpretation of the index. Clare led the

biostatical component, in particular the Principal Components (PCA) and Factor Analysis (FA). Following her lead I also ran PCA and FA to test different combinations. June was primarily responsible for developing the dataset and operationalizing the required variables for analysis. All members contributed to roundtable discussions relating to the dataset restrictions and variable creation parameters and subsequent interpretations of the PCA and FA results. The mapping of the index was completed by me and the initial analyses seeking to validate and further understand the index were conducted jointly with team members.

All the subsequent theoretical work in Chapter Four and epidemiological analyses discussed in Chapters Five, Six, Seven and Eight were designed, executed and interpreted by me. For example, while I made use of June's previous programmes and formats I adapted them for the specific analyses required and ran them in the Statistics New Zealand secure data laboratory and on the New Zealand Health Survey datasets. I received practical support and guidance from June, Clare and my supervisors, primarily based around advice on programmes and discussions on various analytical techniques and interpretations of the results.

1.1.1 Secondary Data Sources

Secondary data sources were used for the creation of the neighbourhood measure and for subsequent health outcome analyses. The 1996 and 2001 New Zealand national census databases were used for creating the social fragmentation measure itself. The health outcomes available for analyses were limited to the secondary datasets that were available (that is, funded by the research project). Smoking data in the 1996 census was also used as an outcome in some analyses. Mental health and other self-reported health outcomes were available in the New Zealand Health Survey (2002/3), a population based survey on health practices, outcomes, and health service utilization.

While the data sources were comprehensive in their coverage of individual characteristics, they were not specifically designed to investigate how individuals' health might be related to neighbourhood characteristics, particularly the social aspects of the neighbourhood. For example it was not possible to investigate how an individual's perception of the neighbourhood might be important for their health, or their interaction with the neighbourhood.

The use of secondary datasets also restricted the ability to incorporate other aspects of the neighbourhood and individuals lives. The historical development of an area, geographical features, and weather conditions and so on will undoubtedly be important for understanding why and how residential neighbourhoods might be an influence on health. However the data sources utilized were cross-sectional. That is to say, they provided a snap shot of people's lives at one point in time. They were therefore unable to provide information on the trajectory which had resulted in an individual's current health status, their individual characteristics, or their area of residence. This had important implications for interpreting the causal processes that might be at play.

1.1.2 Geographic Neighbourhoods, Individual Health

The project and therefore thesis is focused on individuals residing in geographically defined "neighbourhoods" using available administrative boundaries. The social fragmentation index would not be able to measure, for example, other contexts that individuals inhabited, such as communities of interest or work place settings, or to take into account the multiple scales of 'neighbourhood' that may be operating on health outcomes. The scale for the 'neighbourhood' measure had previously been established by the research team as being census area unit (CAU) level (approximately 2000 people). Thus the study has only been able to quantify a single contextual exposure.

However, because a suite of neighbourhood measures was available, the study was not reliant on the single aspect of neighbourhoods. For example, it was important to be able to consider the interrelationship between the social and material characteristics of a neighbourhood by including neighbourhood deprivation and fragmentation together in analyses.

1.1.3 Neighbourhood-level Social Fragmentation

The social fragmentation construct fits broadly into the social properties of neighbourhoods, along with the more commonly used social cohesion and capital constructs. A difficulty faced over the course of the thesis was managing the breadth and complexity of the social capital discourse. The decision was made early on to focus on social fragmentation, and use that as a means of better understanding the social properties of neighbourhoods. The interest in social capital was then necessarily focused on the relationship between social fragmentation and social capital, and how the study of the former might inform the debate around the latter, within the wider context of the neighbourhoods and health research. Research that examined the constructs of social integration, social cohesion, social capital and collective efficacy are discussed in this thesis, but only in their relation to social fragmentation. Rather than restricting understanding, it is hoped that the approach has allowed a stronger contribution to the field by enabling me to step back and view the social properties research more holistically.

1.1.4 The Student

A final parameter influencing how the thesis has taken shape is my own personal background. My academic background is in the social sciences, with an interest in individual outcomes, but also in broader social processes and institutions. The Neighbourhoods and Health project was an opportunity to develop those interests in a new academic setting. Taking on the highly quantitative nature of the epidemiological approach required here has been a challenge, to say the least.

Observing my shift from implementing a set of epidemiological tools to employing an epidemiological framework has been an important personal achievement over the course of study.

The obvious and far more sensible approach to the thesis would have been to focus on the social epidemiological aspects of the project. However, as is often the case with doctoral studies I responded to a need to take the study one step further, and bring a specific theoretical focus from my previous work to the study. As the study progressed it became increasingly clear to me that synthesizing social theory and epidemiology would increase the contribution to the field. Finding a means of asking not just how social fragmentation might be related to health, but why, became the primary focus of the thesis.

1.2 Thesis Outline

My progress through the thesis has necessarily been presented as though it had happened in a linear fashion. As Carpiano and Daley (Carpiano and Daley, 2006b) point out, whether the process of theory building be messy or more structured, it is fundamentally incremental. The reality in this thesis has been a far more iterative process with theory being made visible in the data, and observing data an important part of generating theory. It is hoped that some of the informative 'messiness' has remained, but in a 'tidy' manner.

The parameters described above had important consequences for the progression of the thesis and the final product. Two factors in particular are worth mentioning at this point. Rather than beginning the investigation with, for example, a comprehensive review of theories of social fragmentation, the development of the index was necessarily the first task of the thesis to fit in with project timelines. Once the index was created, my attention then turned to questioning why that particular

collection of variables might be related to health. Overall, this had the effect of turning the attention of the thesis to the exploration of social fragmentation itself.

Secondly, the opportunistic use of the smoking data in the 1996 Census illustrated the differences in disciplinary approaches employed here. The census dataset was an epidemiological goldmine, but unfortunately the social theorist did not know what the gold would look like. The smoking data was a key driver to stop before we started digging and develop a clearer understanding of how and why social fragmentation might be related to smoking and other health outcomes, before embarking on analyses. Thus, the index prompted the theory-building endeavour; the analyses became tests of the theory; the theory a means of interpreting the associations; and the theory and data combined to be a means of examining further how and why neighbourhood fragmentation might matter for health.

Chapter Two provides the research background to the study highlighting a number of key challenges that were able to be addressed in this thesis. The review demonstrated the utility of investigating the social fragmentation/health relationship as a case study for issues raised in the wider sector. The first section focuses on a systematic review of the small body of work that has investigated the relationship between neighbourhood-level social fragmentation and health. Primarily examining mental health outcomes (notably suicide, deliberate self-harm, and psychiatric outcomes), it encompassed a range of methods and scales of 'neighbourhoods'. Broadly speaking, a number of studies found that social fragmentation was a stronger contributor than neighbourhood deprivation to variations in health outcomes. The findings for non-suicide mortality outcomes and mental health morbidity outcomes were less clear. To date the work has predominantly been based in 'ecological' analyses that have been unable to shed light on the contribution of individual factors to the associations. The definitions or conceptualisations of social

fragmentation were limited leaving some uncertainty in my mind what the construct was and why it would be related to health.

The second part of the review chapter turned to the general neighbourhoods and health research field. Obviously, not all the challenges raised in the literature would be able to be addressed here, but their importance still needed to be recognized. A consistent and overarching critique was the need to have research driven by clearly specified conceptual models of the exposure, that determine how it should be measured, and the specific pathways to health in a given population.

The following chapters sought to address matters raised in the social fragmentation and wider neighbourhoods and health literature in a series of steps: creating a measure; developing a theoretical framework for why that measure might be related to health; establishing and operationalizing the epidemiological means for testing that relationship; and finally integrating the theory and data to better understand how and why neighbourhood-level social fragmentation might be related to health. Chapter Three describes the creation of a measure of neighbourhood social fragmentation. Starting from a conceptual model of fragmentation, three domains were theorized as antecedent to collectiveness of a neighbourhood: the means of sharing of norms and values across a neighbourhood, attachment to people and place, and social resources. Fragmentation was a lack in the domains: fewer means of sharing norms and values, less attachment, fewer social resources. The conceptual model was then operationalized, resulting in a nine variable Index of Neighbourhood Social Fragmentation. The chapter describes the relationship of the index to other neighbourhood level measures and also to individual factors.

The next two chapters link the index to health, and act as the means of illumination. The theoretical link is made in Chapter Four, and the empirical means of observing the theory in Chapter Five. Chapter Four seeks to better understand how

fragmentation at the neighbourhood level might theoretically be related to health. The chapter is divided into two sections. The first returns to Durkheim's original theses to establish how the geographical neighbourhood social setting could be acting as a social group. The importance of social groups in Durkheimian terms is discussed, with the conclusion that they are sites where the competing needs of the individual and the collective are balanced. However, importantly, groups vary in how these competing needs are balanced, with variations in the integration and regulation available for individual members.

The second section goes on to relate the theory to the NeighFrag index, arguing that the index is potentially capturing types of neighbourhoods, with varying levels of integration and regulation. Two specific health-related mechanisms are the examined. Firstly, that living in different types of neighbourhoods could be related to mental health, because of the different level of integration and regulation. Secondly, the transmission of health-related social practices (specifically, smoking) within neighbourhoods may vary according to NeighFrag.

Chapter Five provides the means for moving from theory to data in a logical manner by employing a social epidemiological framework. Four pathways were suggested by the theorized mechanisms, capturing the cross-level associations between the neighbourhood exposure and individual health outcomes. The process of developing multilevel analyses to test the pathways from the secondary data sources available is established and described.

Empirical evidence for the theory is then sought in a series of epidemiological analyses, each testing the specified pathways. Statistical processes estimate the associations between the variables as accurately as possible. Chapter Six measures the cross-level relationships between neighbourhood fragmentation and mental health. It was found that increasing fragmentation predicted poorer mental health in

women, even after controlling for known individual confounders, and neighbourhood deprivation. Furthermore, the strength of the association was modified by some individual characteristics. Chapter Seven presents two analyses based on smoking outcomes for youth. In the first section it was found that increasing fragmentation predicted an increasing risk of smoking in 15-19 year olds, but a decreasing risk of smoking in 20-24 year olds. The second section examined the potential 'transmission' of smoking practices within the neighbourhood. It was found that there appeared to be increased transmission in the most fragmented neighbourhoods, which was opposite to that hypothesized.

Chapter Eight brings the theory and data together, asking two questions. Firstly, does the data support the theory? And secondly, were there alternative explanations suggested by the data and theory? Integrating the theory and data proved to be a valuable means of assessing the combined evidence. The thesis concludes with a discussion on the insights gained over the course of the thesis. The integration of data and theory allowed new understandings of what the 'neighbourhood' (and the social fragmentation of it) might mean for individuals and their health, suggesting the thesis has succeeded to some extent in shedding a little more light on the complex relationship between where we live and our health.

Chapter 2

Literature Review

There is a small but growing body of work which has specifically examined the association of social fragmentation at the neighbourhood level with health outcomes. The social fragmentation literature is embedded within a much wider research field that seeks to better understand the relationship between neighbourhoods and health. The following review explores the research issues in both arenas, firstly the more specific social fragmentation literature and then the general field of neighbourhoods and health field research.

The first section considers what is currently known about the social fragmentation/health relationship. The literature has been systematically reviewed to determine the known associations between social fragmentation at the neighbourhood level and various health outcomes. Three aspects were the focus of this review. First, the methods employed in the various studies were reviewed for critical issues in the ability to measure the relationship. Second, definitions or theoretical frameworks for conceptualizing social fragmentation and its relationship with health were reviewed. Finally, the epidemiological evidence for an association was examined, with the caveat that the studies were not necessarily comparable.

The scope in the second section was broadened to examine the background to the social fragmentation research, that is, the more general neighbourhoods and health literature. This part of the review focuses on investigating conceptual and methodological issues pertinent to the social fragmentation literature and this thesis in particular. The intention in reviewing this set of work was not only to challenge me to address new research problems, but to do so with insight into the limitations of any analyses able to be undertaken here.

2.1 Neighbourhood-level Social Fragmentation and Health

The term 'social fragmentation' was first used in recent neighbourhood literature to describe an index developed to explore variation in suicide and parasuicide rates across geographical areas in Greater London (Congdon, 1996b). While the level of neighbourhood deprivation had been shown to predict geographically patterned suicide rates it did not account for all the variation, suggesting that other factors may also be important. In order to better allocate mental health resources it was necessary that more be understood about the spatial distribution of such health outcomes. Congdon's original study therefore sought to create a measure which could better account for the particular distribution of suicide and parasuicide in London.

Congdon was attempting to measure area level factors other than deprivation that may be significant for explaining suicide rate variation (Congdon, 1996b). He called on previous literature which referred to a factor termed "alienation, isolation or social fragmentation (with a converse of familism)" (Congdon, 1996b, p. 13) as well as research which referred to areas with high levels of anomie or social disorganization. Accordingly, an index was created using ward level proportions of four variables thought to capture the Durkheim construct of anomie (Congdon, 1996b). The small area proportions of single-person households, unmarried adults, privately-rented houses, and residential turnover were used to calculate a summary index. It has since become commonly referred to as the Congdon Index and in the interests of clarity shall be referred to as such in this thesis. It was noted by Congdon that the explanatory power of the index was limited to the choice of variables included in the index (Congdon, 1996b). The inferences made from the Congdon measure were therefore dependent on how well the individual variables were judged to capture the construct.

The relative contribution of the Congdon index to variation in health outcomes was assessed by comparing it with a neighbourhood measure of deprivation, the

frequently used Townsend index (Congdon, 1996b). Calculated in the same way as the Congdon index, it measured the area proportions of unemployment, household car access, owner occupied houses, and overcrowding. Congdon was interested in how each area characteristic predicted suicide and parasuicide, independent of the other (Congdon, 1996b). The study found that while the Townsend and Congdon indices were both positively correlated with variation in suicide rates, the relative importance of the two area measures varied. It was also found that the associations were modified by factors such as age and sex, and by the type of area, for example comparing inner and outer London (Congdon, 1996b).

The Congdon index was the stronger contributory factor for suicide rates in the younger age groups, notably in Inner London. In Outer London, deprivation was more significant. Gender was also an important factor for both suicide and parasuicide. While for men less than 60 years old deprivation and social fragmentation were equally significant for suicide, for women, anomie was most important. In general, parasuicide was more strongly associated with deprivation than fragmentation, particularly for men (Congdon, 1996b).

2.1.1 Systematic Review Method

The index developed by Congdon for London has since been used in a variety of other contexts and with different analytical methods and research aims. The literature was systematically reviewed for studies that used the index and other similar measures and published between 1996 and May 2008. The Scopus database was used for searches as it includes both medical and social science literature. The results were also checked against Medline and PsychInfo databases, but no additional papers were located. The search terms “social fragmentation”, “anomie” and “Congdon” were used in combination with “neighbourhood” or “area” to obtain studies that focused on area characteristics other than deprivation or social capital.

The search was then further restricted using the terms “health”, “suicide”, “mental health”, or “mental illness”.

Abstracts (and full texts if needed) were then scanned to select those that used a Congdon-type index. Generally speaking, there appear to be very few other examples of area-based measures that specifically purport to measure social fragmentation or anomie, apart from single variable measures (discussed in following chapters). Papers were excluded if they did not use a small area measure of fragmentation. Researches on country-level comparisons were not included as the interest was on neighbourhood scale analyses.

Because of the wide range of methodologies and outcomes used in the studies it was not appropriate to undertake a formal meta analysis of the association between social fragmentation and health. To a large extent the variety reflects the data available to each researcher, the statistical approaches in use at the time, and the exploratory nature of the field. For example, while correlations can be seen as a relatively statistically crude tool, Smith et al (2001) sought to examine the relative contribution of fragmentation and deprivation to different causes of mortality. Their analytical approach and study design was sufficient for that purpose.

It is worth considering at this point how study design impacted on what was able to be inferred from the analyses. Most of the earlier analyses sought to examine so called ‘ecological’ relationships between neighbourhood characteristics and health outcomes. That is to say, they were interested in examining how factors relating to the nature of the neighbourhood might be associated with neighbourhood health outcomes (as opposed to individual health outcomes). Typically, researchers have used neighbourhood aggregations of population characteristics (for example socioeconomic status) as the ‘exposure’ and neighbourhood aggregations of health status (for example smoking) as the ‘outcome’ (Blakely et al., 2004).

The inferences from such studies would be properly made about populations rather than individuals. Ecological study designs can be useful for examining issues such as the distribution of health services because they help make the link between the composition of a neighbourhood and the likely prevalence of a health outcome such as mental illness. Congdon, for example, was specifically interested in providing evidence for improving the allocation of mental health services in London by seeking to better understand the relationship between variations in the rates of mental health outcomes and contextual factors (Congdon, 1996b).

Fallacious inferences about associations can be made when researchers are interested in relationships at one level, but rely on data from another. For example, researchers are often also interested in mechanisms at the individual level. But information about ecological level associations between area deprivation and area smoking rates can be flawed if used to make inferences about what individual characteristics might be associated with individual smoking due to committing the ecological fallacy (Diez Roux, 2002a). Equally fallacious would be to infer that exposure to area deprivation was causing individual level outcomes without also modelling and adjusting for individual level covariates (known as a sociologic fallacy) (Diez Roux, 2002a).

Going beyond ecological relationships requires different study designs. Increasingly, researchers are explicitly seeking to observe how neighbourhood level factors are related to individual level outcomes with study designs incorporating data at both levels. Such study designs have allowed researchers to examine how individual and neighbourhood risk factors (and, of course other level factors such as the household) might be associated with individual outcomes. Interest has also turned to examining whether area variation in outcomes can be explained by an area's compositional characteristics (because of the aggregation of a given set of characteristics), or if there is a so called "contextual" effect (an effect over and above that which would be expected from a given aggregation).

Given the differences in the studies, the aim of the review was to better understand what has been observed in the literature, how it has been observed, and the nature of the results. The following aspects of the papers have therefore been examined; how social fragmentation was defined; the area characteristics measured; methodological factors, such as scale and setting, outcome measures, analytical methods; and the findings for an association of fragmentation with health.

2.1.2 Results

The selected papers have been summarised in Table 2:1. The table contains (to my knowledge) all papers that use a 'Congdon' type index (or similar) to investigate the relationship between area characteristics and health, published between 1996 and May 2008: a total of fifteen papers. They have been presented in chronological order (in rows) with summary details of the pertinent aspects detailed above in columns. A further set of papers was found that used the index primarily to either explore other factors (Middleton et al., 2003) or to pursue methodological issues (Congdon, 1996a, Congdon, 1997, Congdon, 2003, Congdon, 2004b, Congdon, 2006, Congdon, 2007, Congdon, 2008). The results from these papers were not included in the systematic review as the authors did not specifically discuss the association of fragmentation on health.

The papers are firstly discussed in general terms, comparing study design aspects such as outcomes, methods, and scale, as well as study aims and conceptualizations of social fragmentation. The epidemiological evidence is then examined more closely by morbidity and mortality outcomes.

2.1.2.1 General Factors

The outcomes used with the Congdon index have generally been those related to mental health. While studies using suicide as an outcome were relatively easy to

compare, the measures of mental illness outcomes used in the studies varied widely. Only a smaller set of studies examined non-mental health outcomes (Congdon, 2004a, Smith et al., 2001, Stjarne et al., 2004) but in doing so provided an interesting dimension to understanding the index.

Table 2:1 Published Literature Examining Neighbourhood-Level Social Fragmentation and Health

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|---|---|--|---|--|--|--|---|
| Congdon 1996 | Compare effect of deprivation and fragmentation measures on suicide risk amongst sub populations | Measure equated with 'anomic', social isolation, social fragmentation: converse of 'familism' | Townsend & Congdon Index Prevalence of psychiatric morbidity | Suicide: Wards (ave. pop. 6195) in Greater London parasuicide: North east London | Suicide rates Parasuicide rates (hospital admission) | Correlations Poisson <i>ecological</i> | Fragmentation explains more of variation of suicide in women, but deprivation stronger factor in parasuicide amongst men (each adjusted for other). |
| Whitley, Gunnell, Dorling, Davey Smith 1999 | Compare contribution of fragmentation and deprivation on suicide rates in a national study. Also compared effect of change over time in exposure on suicide rates | Equated 'anomic' with social fragmentation. Voting abstention as another measure of social fragmentation | Townsend & Congdon Index and voting abstention patterns | Parliamentary constituencies Great Britain 1981 & 1991 (averaged measures). Change measured between the two periods | Mortality: Suicide rates, compared with all other causes | Least squares regression <i>ecological</i> | Increased fragmentation associated with increased suicide rates, independent of voting & deprivation. Deprivation a stronger factor with all cause mortality (each adjusted for other). |
| Gunnell, Shepherd & Evans 2000 | Compare contribution of fragmentation and deprivation to DSH rates Examining change in neighbourhood status over time on DSH rates | not defined | Townsend & 3 variable 'fragmentation' (no marital status) | Wards (ave. pop. 6195) Bristol (1971 & 1991) | Deliberate self harm (DSH) rates Presentation at A&E | Correlations and ordinary least squares regression. <i>ecological</i> | Only weak association of fragmentation with DSH rates. No change in rates with change of fragmentation over time. Deprivation a stronger factor (each adjusted for other). |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|--|--|--------------------------|---|---|--|--|
| Davey Smith, Whitely, Dorling & Gunnell 2001 | Cause specific mortality associations with deprivation and fragmentation | Not 'anomic', relates measure to Durkheim's social integration | Townsend & Congdon Index | Parliamentary constituencies Great Britain 1981 & 1991 | Mortality rates | Correlations – simple and partial <i>ecological</i> | Correlations with specific outcomes dependent on exposure. Fragmentation stronger predictor for suicide and cirrhosis (adjusted for deprivation). |
| Hawton, Harriss, Hodder, Simkin & Gunnell 2001 | Are ecological variations in suicide and DSH associated with deprivation and fragmentation? Do individual characteristics of DSH patients reflect their neighbourhood | 'social fragmentation': distinguishes from 'anomic'; but does not explain further. | Townsend & Congdon Index | Wards (ave. pop. 6195) Oxfordshire Excluded areas with high levels of non-private, mobile residents | Suicide, DSH rates Presented to hospital | Correlations Weighted least squares regression <i>ecological</i> | Approx. half the increase in DSH rates for fragmentation and DSH compared to association for deprivation (adjusted for other exposure). No increase in suicide rates for fragmentation DSH patients in high and low fragmentation wards generally reflect their neighbourhood |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|--|---|---|---|---|--|--|
| Middleton, Whitley, Frankel, Dorling, Sterne, Gunnell 2004 | Comparing associations at different scales of geography; and index with single indicators | factors which contribute to social integration in an area | Townsend & Congdon Index & component variables | Ward (ave. pop. 6195) and constituency level England | Suicide rates | Negative binomial regression <i>ecological</i> | Fragmentation associated with increased suicide risk (adjusted). Effect size varied by sex and age and was larger at ward level. |
| Stjarne, Ponce de Leon, Hallqvist 2004 | Association of fragmentation with heart disease | limited opportunity for local social integration; social collective functioning | Townsend & Congdon Index, individual factors | Stockholm county, Sweden urban 'small residential area' (ave. pop 1142) | Myocardial infarction | random intercept logistic regressions <i>multilevel</i> | Small increase in MI rates associated with fragmentation after controlling for individual and deprivation factors. Unable to determine independence between factors. |
| Congdon 2004 | Commentary on Stjarne et al. Comparing different measures of deprivation. Cause specific associations. | Presence of community, institutional, and personal ties within a small area. | Congdon Index and deprivation (social housing, unemployment, occupation status) | English Local authority | Mortality rates Suicide and coronary heart disease | Standardized Mortality Ratios <i>ecological</i> | Suicide: fragmentation biggest increase for women; deprivation for men. CHD: no increase with fragmentation |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|---|--|---|--------------------------------|---|---|---|
| Evans, Middleton, Gunnell 2004 | Is the association between suicide and fragmentation explained by prevalence of severe mental illness | Links social fragmentation measure with Durkheim's social integration – highly integrated societies have low rates of suicide. | Townsend, Congdon Index & prevalence of psychiatric admissions | Wards (ave. pop. 6195) Bristol | Suicide rates Psychiatric admissions | Negative binomial regression <i>ecological</i> | Suicide – only small attenuation in increased risk associated with fragmentation after controlling for level of mental illness. Increased psychiatric admissions also associated with fragmentation, but prevalence of admissions largely explained this. |
| Allardyce, Gilmour, Atkinson, Rapson, Bishop, McCreadie 2005 | Fragmentation, deprivation, and urban/ rural factors and psychoses. | Equates anomie with social fragmentation, and conversely, cohesion. | Congdon Index, Carstairs (deprivation measure) and Urban / rural (6 categories) | Postcodes. Scotland | First time psychiatric admissions | Logistic regression <i>ecological</i> | Increased rates of admission for fragmentation over two times size of association seen for deprivation (each adjusted for other). |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|---|---|---|---|--|--|--|
| Curtis, Copeland, Fagg, Congdon, Almog, Fitzpatrick 2007 | Contextual factors influencing psychiatric admission rates | “anomie”, social isolation or fragmentation. not further defined | Deprivation, Congdon Index racial composition, proximity to services | Wards - Greater London & Zip Code Areas - New York | Acute psychiatric hospital admissions (excluding self harm), drug related outcomes, schizophrenia, & affective disorders | Poisson regression <i>ecological</i> | In NY fragmentation associated with increased schizophrenia & affective disorders. In London fragmentation associated with increased admission rates for schizophrenia & affective disorders, & drug outcomes for women. |
| Fagg, Curtis, Stansfield, Congdon 2006 | Area variations in Adolescent’s mental health. Contribution of contextual factors, including fragmentation. Interaction between factors | Congdon index referred to a s measure of community level social fragmentation, the converse of cohesion | Index of Deprivation, Congdon Index Ethnic concentration & individual factors | Small area administrative areas (Middle Layer Super Output Areas, ave. pop. 6767) Inner city London, UK | Psychological distress in adolescents (11-14 year olds) | Bayesian regression controlling for individual and family characteristics <i>multilevel</i> | Area characteristics (including fragmentation) did not predict increased distress, except ethnic density |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|---|--|--|--|--|--|--|
| Corcoran, Arensman, Perry 2007 | Area characteristics; fragmentation, deprivation, urban / rural; and rates of DSH. Interactions between contextual factors and age and gender. | Not defined | Irish National deprivation Index for Health and Health Services Research, Congdon Index, urban / rural | Electoral divisions Ireland | DSH presentation at hospital | Negative binomial regression <i>ecological</i> | Fragmentation was associated with increased DSH rates but deprivation had a stronger effect. Effect modified by age but not gender. Effect modified by area type: independent of deprivation in rural areas only; protective effect for younger people in Dublin |
| Fagg, Curtis, Stansfield, Cattell, Tupuola, Arephin 2008 | Is there an association of fragmentation with individual psychosocial health in young people? Does social support buffer the effect of fragmentation? | Converse of social cohesion. Fragmentation may lead to low levels of social capital, interruption of neighbourhood networks and so on. | Congdon, Index of deprivation, individual factors | Super Output Area level (ave. pop. 1500) England | Psychological distress - General Health Questionnaire (GHQ) Ages 16-24 | logistic regression controlling for individual and area characteristics, with adjustment for clustering and robust errors <i>multilevel</i> | More distress associated with increasing fragmentation, (adjusted). No interaction between social support and fragmentation. |

| Paper Author(s) & Year | Aim of Study | Definition of Social Fragmentation | Exposures | Scale | Outcome(s) | Analytical Methods | Fragmentation Findings |
|--|--|---|--|---|---------------------------------|---|--|
| O'Reilly, Rosato, Connolly & Cardwell 2008 | Is the association of fragmentation and suicide because of context or composition? | "social fragmentation" not further defined. | Congdon Index, population density, material deprivation (proportion on means tested benefits), individual factors. | Super Output Area level (ave. pop. 1894) Northern Ireland | Suicide 5 year follow up cohort | Generalized Estimating Equation logistic regression for area factors. Cox proportional hazard ratios (HR) for individual and household level factors <i>multilevel</i> | Fragmentation or deprivation not associated with increased suicide risk (adjusted). Weak adverse effect of low population density on suicide risk. |

Study designs changed considerably across the papers. As can be seen in Table 2:1, the earlier studies were primarily ecological in design, examining relationships between the Congdon index and aggregations of health outcomes. Some researchers sought to examine whether ecological type associations between fragmentation and suicide or hospital admissions may be due to the makeup of the neighbourhood, for example examining the prevalence of illness (Evans et al., 2004). In later multilevel studies, the emphasis turned to examining the effects of area level and individual level factors on the individual risk of the relevant health outcome (Fagg et al., 2008, O'Reilly et al., 2008, Stjarne et al., 2004, Fagg et al., 2006). Multilevel statistical approaches enabled researchers to use non-neighbourhood level variables to address confounding (and thereby reducing sociologic fallacies) and to investigate possible individual-level mediating mechanisms. They also allowed researchers to examine and statistically adjust for the degree of non-independence in the data: that is, the degree of clustering by area (Diez-Roux, 2000). The sole mortality multilevel study overturned the findings from ecological analyses (O'Reilly et al., 2008); it remains to be seen whether this was due to factors to do with study design (setting, time period, cohort design), the statistical processes used, or if the results were due to chance, bias, or statistical artefact.

The scale and setting of the geographic area varied across the studies. Generally, researchers have been forced to rely on selecting what they regarded as the most appropriately sized administrative area unit rather than being able to use scales that have natural community boundaries. They ranged from the very small (average population of 25) (Fagg et al., 2006) to wards (average population of 1,500-2,00) to much larger areas such as local authorities (Congdon, 2004a) and electoral constituencies (Smith et al., 2001, Whitley et al., 1999, Corcoran et al., 2007). More recently researchers have made more explicit attempts to use scales that better capture actual neighbourhood variation rather than an aggregation of several 'neighbourhoods' (Fagg et al., 2008, Fagg et al., 2006). Some were located in cities or

regions, others at a national level, and still others compared settings across countries. While most studies were cross-sectional, a few were able to introduce a time component by comparing changes in social fragmentation levels across time (Gunnell et al., 2000, Whitley et al., 1999).

The differences between settings provided some opportunity to test the consistency of the relationships. For example the contrasts between city and nation datasets, as well as the combination of urban settings such as Greater London and more mixed regions such as Oxfordshire enabled researchers to examine the processes that may be driving the associations (Hawton et al., 2001). Nevertheless it is notable that many of the studies were conducted in the United Kingdom and were therefore using components of the same population.

Three studies provided contrast in their study setting. Stjarne et al (2004) conducted their study in Sweden. However the outcome was not directly related to mental health and therefore the finding that deprivation was a stronger factor than fragmentation for heart disease could have been due to either different social processes, or the inter-country differences. One study compared the association of the Congdon index and psychiatric illnesses across countries (Allardyce et al., 2005, Curtis et al., 2006), allowing for a more robust comparison. They found that fragmentation was associated with admission rates in both New York and London but with some differences in the cause specific admissions, with drug-related admissions associated with fragmentation in New York only (further discussion below).

The theoretical understanding of social fragmentation has generally received less attention than study design in the papers. A noticeable feature of many papers is the brevity in defining or explaining social fragmentation. While this may have been a constraint of the journal format, it is interesting that there was comparatively little

space given to defining what the researchers think they are measuring, and why it might be related to health. It is certainly in sharp contrast to the considerable volume of literature on social capital. However, this may well reflect the exploratory nature of the earlier research and provides a good example of a collection of observations from which theory can be developed (Greenland et al., 2004).

While Congdon used a range of terms to describe what was being captured by the index, most researchers have settled on either 'anomie' or 'social fragmentation' - sometimes interchangeably (Allardyce et al., 2005, Corcoran et al., 2007, Gunnell et al., 2000, Middleton et al., 2004, O'Reilly et al., 2008). Some authors queried the appropriateness of the term 'anomie' in describing the index, arguing that for Durkheim, 'anomie' was different from either fragmentation or integration (Hawton et al., 2001, Smith et al., 2001). In the more recent papers, 'social fragmentation' appears to be the preferred term, and is generally defined as the inverse of either cohesion or integration (Allardyce et al., 2005, Evans et al., 2004, Fagg et al., 2006, Fagg et al., 2008). For example, Fagg and colleagues (Fagg et al., 2008) described social fragmentation as a paucity of cohesion, which was in turn needed for the maintenance of social capital (in their terms, reciprocity, trust, informal social control and so on).

Congdon's 2004 commentary provided one of the more detailed definitions of the construct the index was attempting to measure (Congdon, 2004a). Firstly, he argued that the construct needs to be seen as distinct from both deprivation and social disorganization (discussed below). Secondly, he regarded fragmentation (or conversely cohesion) as describing the level of "social integration and social support resting on noninstitutional [sic] ties (with partners, families) and on institutional and community ties." (Congdon, 2004a, p. 741).

As highlighted in the table, a common aim in most studies was to compare the contribution of the Congdon index to variation in outcomes independent of deprivation measures. Generally speaking, there was little discussion of how the Congdon index or the social fragmentation construct might be more important for the outcomes examined than the deprivation measures. Some authors discussed the need to look at factors other than the material deprivation of a local area. In these studies, the Congdon index was framed as capturing aspects of the non-material environment. More recently there has been a shift to a more complex modelling of social fragmentation. Fagg and colleagues, for example, asked if the social fragmentation level of a neighbourhood would modify the effect of social support offered by other social settings such as the family (Fagg et al., 2008). While no such interaction was observed, their study was valuable for the shift in thinking about how social fragmentation might be related to health.

The findings of the studies with regard to social fragmentation will be discussed by outcome type; first mortality, and then morbidity. Within each outcome group, the implications for the findings of differences in methodologies and other factors highlighted in the table will also be considered.

2.1.2.2 Mortality Outcomes

All but one of the studies examining suicide mortality as an outcome used an ecological design (the exception being O'Reilly (2008) which is discussed below). In the ecological studies a common aim was to compare the relative contribution of fragmentation and deprivation to suicide and related health outcomes (Congdon, 1996b, Gunnell et al., 2000, Hawton et al., 2001, Middleton et al., 2004, Smith et al., 2001, Stjarne et al., 2004, Whitley et al., 1999). The general pattern of findings in the ecological studies was that while both were found to predict variations in suicide, the Congdon index was associated with larger increases in the variation of suicide rates or risk than deprivation (Congdon, 1996b, Congdon, 2004a, Evans et al., 2004,

Middleton et al., 2004, Smith et al., 2001, Whitley et al., 1999). That is to say, areas with higher levels of fragmentation (as measured by the Congdon index) had higher rates or risk of suicide, even after controlling for the level of neighbourhood deprivation in those areas. On the other hand, the association between the suicide and deprivation was not necessarily 'explained away' neighbourhood fragmentation. Rather when researchers compared effect sizes between the neighbourhood measures the magnitude of the association for fragmentation was larger than deprivation, suggesting that it was the stronger contextual factor.

The association between suicide and the Congdon index remained across the studies despite variations in the scale of 'neighbourhood', and in the settings and measures of association employed. These studies used a range of area scales from wards (averaging approximately 1500-2000) (Congdon, 1996b, Evans et al., 2004, Middleton et al., 2004) to larger areas that cannot be conceived of as local neighbourhoods such as parliamentary constituencies (Middleton et al., 2004, Smith et al., 2001, Whitley et al., 1999) and local authorities (Congdon, 2004b). Middleton et al (2004) were interested in the effect of scale on the associations observed and compared the size of the association when area characteristics were measured at both ward and constituency level. They found that while the effect size for deprivation diminished as scale decreased, the opposite was true for fragmentation; as the scale decreased; the effect size was larger for smaller scale neighbourhoods (Middleton et al., 2004).

The settings of the studies reported above varied from single regional cities (Evans et al., 2004) to national data (Congdon, 2004a, Middleton et al., 2004, Smith et al., 2001). Hawton et al's (2001) ecological study was set in Oxfordshire, United Kingdom, and therefore represented a mixed urban/rural setting. No association with suicide was observed for the Congdon index after controlling for deprivation, in contrast with other studies (Hawton et al., 2001). Two factors may have contributed to this null finding in the Oxfordshire study. Firstly, there were notably smaller numbers of

suicides compared with other studies. Secondly, an aspect of this study not commented on by the authors was that the exposures were calculated after specific areas with high proportions of non-private dwellings and non-permanent populations were excluded. Given that the setting was Oxfordshire, an area with a high proportion of students, teaching hospitals and so on, it may be that the lack of observed association was caused by the omission of these areas which may have severely reduced the range of fragmentation that was able to be captured by the index.

There was some suggestion of specificity in the association of the Congdon index with health outcomes. The findings for non-suicide mortality were consistent; fragmentation was not a strong factor and was weaker than deprivation. This was so when all-cause mortality was examined (with suicide excluded) (Whitley et al., 1999), and when the relative effects for cause specific mortalities were analysed (Smith et al., 2001, Congdon, 2004a). Smith et al (2001) observed that when adjusting for deprivation, a number of non-suicide causes were inversely correlated with fragmentation, but in all cases other than cirrhosis the correlation with deprivation was stronger. Deprivation and fragmentation were roughly equally correlated with cirrhosis related mortality. Authors have interpreted these results as an indication of the need to consider how measures of the social environment need to be included when understanding ecological variations, beyond the usual deprivation measures (Smith et al., 2001).

In the ecological analyses above, a common caveat to the findings recognized by the authors was that they may well reflect the characteristics of the residents of areas, rather than any contextual effect over and above the composition of the area. While authors clearly state that the intent of ecological analysis is to better inform us about risky areas, which was highly relevant to planning services and so on, there was little

means of explaining why the particular aggregation of individual factors captured by the Congdon index would act as a risk factor (Whitley et al., 1999).

Three approaches were used to investigate further. Some studies have specifically sought to investigate whether the association of fragmentation on mental health outcomes could be explained by the prevalence of psychiatric morbidity, and it does appear that this may be part of the explanation or pathway (Evans et al., 2004). Evans and colleagues used psychiatric admission rates to calculate the prevalence of mental illness. They found that the association of suicide and fragmentation was moderately attenuated after controlling for the admission rate, but remained with a 23% increase in the suicide risk per quartile increase in fragmentation. They argued that the social fragmentation/suicide association could not therefore be completely explained by the prevalence of mental illness (Evans et al., 2004). It has to be noted however, that admission rates would not necessarily capture the 'true' rate of severe mental illness and that the social fragmentation/suicide association may still be confounded by a higher prevalence of mental illness in highly fragmented areas.

Another approach was taken by Hawton and colleagues (2001). They were interested in whether the relationship between fragmentation and mental health outcomes could be confounded by individual characteristics. They found that patients admitted to hospital generally shared similar characteristics with their neighbours. For example, those in the most fragmented neighbourhoods were more likely to live alone than those living in the least fragmented neighbourhoods. The authors argued that it did not therefore appear that the relationship between the area characteristics and mental health outcomes could be explained by patients being substantially different from their fellow residents. Again, the researchers were only able to include those who were mentally ill who were admitted to hospital and whose records contained the required information. It is therefore plausible that the associations observed were subject to selection bias if mentally ill residents who were not

included in the study demonstrated a different relationship with fragmentation than those who were included.

Because this study and others relying on hospital admissions were dependent on hospital records, bias in the observed associations could also have occurred because of misclassification by exposure, outcome or covariates. Hospital records were used for classifying participants' area of residence, outcome status, and individual factors such as household composition where available. It may be, for example, that there was an increased likelihood of inaccurate records for those living in more highly fragmented neighbourhoods with less social support. If the likelihood of misclassification by exposure was different by mental health status, the 'true' association may well have been under- or over- estimated.

In another approach, researchers have used multilevel analyses to assess the degree to which variation of the outcome can be attributed to the neighbourhood, rather than an aggregation of individuals. Multilevel datasets also allowed researchers to observe neighbourhood level risk factors while simultaneously adjusting for non-neighbourhood-level confounders, such as socioeconomic factors. The single multilevel mortality study in the review used mortality records from a five year period that were linked to individual and neighbourhood census data in Northern Ireland (O'Reilly et al., 2008). This provided a cohort with a multilevel data structure, enabling researchers to move beyond ecological cross-sectional analyses. Analyses revealed that crude associations between both fragmentation and deprivation disappeared with suicide when more proximal confounding factors were included in the regression. The authors concluded that, for this cohort, any association between these area characteristics and suicide was due to composition of the neighbourhood, rather than the characteristics of the local area itself (O'Reilly et al., 2008).

2.1.2.3 Morbidity Outcomes

Morbidity outcomes demonstrated a more complicated relationship with social fragmentation in the reviewed literature. There was a relatively small range in the type of non-fatal outcomes examined in the literature. This may indicate the difficulties in obtaining good measures of non-fatal health outcomes that were perceived by researchers to be related to social fragmentation. The main focus was on psychiatric illness outcomes – perhaps because of their recognized relationship with suicide.

Initially the research focused on parasuicide and deliberate self-harm (DSH), known to be related to suicide but with different drivers (Congdon, 1996b, Corcoran et al., 2007, Gunnell et al., 2000, Hawton et al., 2001). Congdon argued that the differing causal profiles of suicide and parasuicide should result in differing relationships with area characteristics, with deprivation being a stronger factor for parasuicide (Congdon, 1996b). Comparing the relationship of fragmentation with suicide and parasuicide/DSH outcomes provided a way of seeing how the same factor might mean different things for each outcome, shedding light on both aspects.

Authors acknowledged the difficulties in developing consistent measures of psychiatric outcome measures such as deliberate self-harm (DSH) for use in analyses (Gunnell et al., 2000, Congdon, 1996b). Congdon's original work used hospital admissions as the outcome measure, which was recognized as only a crude measure of actual rates (Congdon, 1996b). Apart from the issues of bias discussed above, authors also acknowledge that admission rates may reflect local practices rather than prevalence (Gunnell et al., 2000, Hawton et al., 2001). While DSH may also be treated away from hospitals, the accessible data is often limited to hospital records. The comparatively recent uses of registers of DSH have provided researchers with a more consistent data source (Corcoran et al., 2007, Gunnell et al., 2000).

Generally speaking, deprivation was the stronger factor than fragmentation for predicting the risk of parasuicide or deliberate self-harm (DSH) outcomes, in contrast to suicide (Congdon, 1996b, Congdon, 2004a, Gunnell et al., 2000). Some authors were able to examine differences in the effect sizes by other factors such as age, gender and urban/rural differences (Congdon, 1996b, Corcoran et al., 2007). In Ireland, Corcoran et al (2007) found that fragmentation did have an association with DSH presentation independent of deprivation, but only in rural areas. Furthermore, they observed a protective association for younger people in the highly urban Dublin area, with increasing levels of fragmentation being associated with lower rates of presentation. On the other hand, in Greater London, Congdon observed that deprivation remained the stronger factor for all sub-groups, but particularly for men. He also observed differences in the effect of area characteristics between types of areas, for example, inner and outer London and between age groups, suggesting either a more complex relationship or the possibility of chance findings (Congdon, 1996b).

Social fragmentation has been shown to be a stronger contextual factor for other measures of mental health morbidity. The effect size for fragmentation remained larger than that observed for deprivation when the outcome measure was psychiatric hospital admissions (rather than DSH), even when they were both included simultaneously (Allardyce et al., 2005, Evans et al., 2004). Evans et al examined all psychiatric admissions, which were found to be independently associated with fragmentation, but the effect size was largely attenuated by the prevalence of admissions (Evans et al., 2004). Allardyce et al (2005) looked specifically at first time admissions, and compared the association of area characteristics with admissions across urban and rural settings. For this specific category of patients the odds ratios for fragmentation suggested that it was a considerably stronger factor, with the estimate for the highest level of fragmentation over two times that for the highest level of deprivation (when each adjusted for the other).

In a cross national study, Curtis et al (2006) were able to examine the relationship of fragmentation with specific categories of psychiatric admission (Curtis et al., 2006). As well as being able to compare across two large metropolitan settings (New York and London), they were able to examine contextual effects of ethnic segregation and proximity to services. Consistent with other studies, fragmentation was associated with increased illness rates, independent of deprivation. What was interesting, however, was that the association with each category varied across the two settings and by sex. In both cities, schizophrenia and affective disorders were predicted by fragmentation. On the other hand fragmentation was associated with an increase in substance abuse related admissions for only women in New York and for neither sex in London (Curtis et al., 2006).

More recently, researchers have used survey data enabling them to examine other mental health outcomes such as psychological distress. Both studies measure psychological distress and both focus on youth populations in London, but this time take into account non-neighbourhood-level factors. The studies created multilevel datasets by using residential address to append data on neighbourhood characteristics to individual observations. As well as capturing individual level data linked to area measures, both studies obtained information on intermediary level contexts such as families and proximal peer support (Fagg et al., 2008, Fagg et al., 2006). After including individual level factors, one found no relationship between fragmentation and psychological distress (Fagg et al., 2006); the other that distress increases with increasing fragmentation (Fagg et al., 2008).

In the first study, the authors were interested in whether variations in adolescents' psychological distress could be attributed to area characteristics, of which fragmentation was one. Using a Bayesian analysis, they concluded that while some variation in distress between neighbourhoods existed (even when controlling for individual and family level factors) measures of deprivation, crime rates or

fragmentation did not appear to be predictors of that variation (Fagg et al., 2006). The authors concluded that the lack of an association between the contextual variables and distress could have been because they were not relevant contextual exposures for the participants, or because there was insufficient variation between areas (Fagg et al., 2006).

The later study suggested the former explanation may have been the case. Firstly, the authors were interested in whether there was a direct relationship between area fragmentation levels and distress in young adults (16-24 years) (Fagg et al., 2008). The analyses revealed this to be the case; higher levels of distress were observed in young adults living in the highest levels of fragmentation, even after controlling for individual level factors and clustering (note that a full multilevel analysis was not employed as there were insufficient numbers of participants in the small neighbourhoods). No such relationship was observed for deprivation (Fagg et al., 2008). However they did not include deprivation in the full model testing social fragmentation, therefore no comment could be made on the independence of the fragmentation and deprivation associations with psychological distress. The second study also used a smaller scale neighbourhood compared to the first study (average population of 1,500 compared to 6,767). This suggested that the scale of the neighbourhood may also be important for the psychological distress outcome, in keeping with Middleton et al's earlier finding (Middleton et al., 2004). However no conclusion can be drawn here as the difference in findings could also be attributed to differences in the age groups of the two studies.

But the authors were also interested in whether the effect of proximal social support, such as from family and friends, might be modified by the community level of fragmentation. They found no evidence of an interaction but did observe that within each strata of fragmentation there was considerable variability in the degree of

distress reported, with evidence that more proximal sources of support from families was associated with less distress (Fagg et al., 2008).

As an interesting contrast, the first study employing a multilevel design with the Congdon index used myocardial infarction rather than mental health outcomes. Set in Sweden, Stjarne (2004) used the Congdon index to examine the contribution of area characteristics to explaining variations in heart disease. As well as area measures of deprivation and fragmentation, the authors were able to control for individual level socioeconomic confounders. They concluded that while fragmentation was associated with heart disease after controlling for other factors, deprivation predicted larger variation in rates when both area exposures were included in the regression model. However, they felt unable to determine which exposure was the more important because of the high correlation between the measures (Stjarne et al., 2004).

As with the mortality studies discussed above, the morbidity studies also used a variety of scales and settings. A trend in more recent papers is towards the use of scales smaller than wards (Allardyce et al., 2005, Fagg et al., 2006, Fagg et al., 2008, O'Reilly et al., 2008). While these areas are still based on administrative boundaries the authors argue that they are more likely to capture homogenous neighbourhoods that are most socially relevant to residents (Fagg et al., 2006).

2.1.3 Conclusions: Future Directions in Social Fragmentation and Health Research

The above papers present a mixture of evidence for an association of area level fragmentation (as measured by the Congdon index), with the health of residents. It would appear that there is consistent evidence for an ecological relationship between suicide mortality and the Congdon index, and that fragmentation is a separate and stronger factor than deprivation. However, initial evidence from multilevel analyses

which take into account individual factors suggests that the ecological association may be due to the way in which individuals aggregate in certain areas.

The evidence around morbidity is less clear. While ecological analyses show reasonably consistently that deprivation is a stronger factor in predicting DSH, other measures of mental health show varying associations with fragmentation. Non DSH psychiatric admissions show some associations with fragmentation for some sub-populations, when controlling for other area level characteristics. There is also some evidence that the effect of fragmentation on measures of psychological distress in young people remained, even when individual level factors are controlled for.

Most studies have been undertaken in the United Kingdom, or similar highly urbanized settings such as New York. While they have been conducted in a range of settings, subsequent 'confirmatory' analyses have therefore used essentially the same population. It is possible that any association between neighbourhood level fragmentation and health outcomes is specific to factors within that setting, such as high population density (compared to New Zealand), residential mobility trends, or health service delivery modes. It should be noted, however, that the interest in examining associations across different settings could most usefully be seen as further evidence of societal processes as well as confirmation (or not) of a country specific effect (Macintyre et al., 2002).

The literature suggests that there are strong reasons to further investigate the relationship between health and social fragmentation at the neighbourhood level. To date, the research has focused on mental illness outcomes. More recent papers have used survey data which has allowed researchers to collect data on a wider range of confounding, moderating and mediating factors. However these studies were not able to employ a full multilevel analysis such as random effects modelling as there were insufficient numbers of survey participants by area to investigate clustering.

The relative contribution of fragmentation and deprivation to health remains an ongoing research question. The two exposures appear to be closely linked in what could be either a confounding or mediating relationship. The potential for fragmentation to act as an effect modifier to deprivation also offers an interesting research question.

The association of fragmentation and health appeared to vary by area and individual factors. To date, there appear to be consistent differences in the fragmentation/health relationship by rurality and gender which require further investigation. There is also some suggestion that age may be an important factor in understanding how residents migrate between neighbourhoods, which may be important in understanding both the meaning and effect of fragmentation (Congdon, 2004a).

Having established patterns of association between social fragmentation and health, it would appear that researchers' attention has more recently turned to causal inference. In order to move beyond ecological and sociologicistic fallacies in particular, researchers are employing conceptual models and multilevel analyses to examine questions around why social fragmentation might be associated with health outcomes. In line with this is an increased emphasis on a more sophisticated definition of the construct, particularly in the work of Fagg and colleagues (Fagg et al., 2008). However, there were still calls for an updated measurement of the construct (Congdon, 2004a, Stjarne et al., 2004).

Questions remain as to what has been captured by the Congdon index. Does the apparent specificity of the association with mental health outcomes suggest that the index is capturing geographical patterns of psychiatric illness and suicide or does it actually capture something about so-called 'community ties' as suggested by Congdon (2004a)? If the former were the case it may be that the associations

observed above can be explained by aggregations of vulnerable people, with the next question asking why such people might aggregate in highly fragmented neighbourhoods. If the latter were the case, it would suggest that the Congdon index is measuring an aspect of the 'social' environment in a similar way that indices such as the Townsend index are thought to capture the 'material' environment. The question turns to why the fragmented neighbourhood social environment (or 'community ties') might have consequences for mental health.

A noticeable lack in the field is a discussion of what the Congdon index is capturing about the neighbourhood and how it might be related to other properties of neighbourhoods. There is little debate, for example, of how social fragmentation and other neighbourhood social properties might be related. While Congdon usefully distinguishes between social fragmentation and disorganisation there is no further discussion of how they might be correlated – both statistically and theoretically. There is little mention of other neighbourhood social properties such as segregation, income inequality and so forth that may or may not be related to neighbourhood-level fragmentation. Fagg et al (Fagg et al., 2008) argue that social fragmentation is the converse of social cohesion with clearly stated pathways to health, but fail to make clear why the particular *composition* of a neighbourhood captured by the Congdon index might be a measure of the actual level of cohesion (and therefore social capital) within a neighbourhood. There is also little reference to the wider research that examines processes of anomie or social fragmentation at a societal level, for example, the work on urbanisation (Wallace et al., 1997, Fullilove et al., 1998) or changes in societal structure and anomie (Watson, 1995, Makinen, 2000).

The review of the social fragmentation literature presented above has illustrated some of the key issues within the wider neighbourhoods and health research field. The difficulties conceptualizing, defining and measuring neighbourhood exposures such as social fragmentation have been well recognized (see more discussion on this

point below). Important questions continue to be raised about how to conceive and investigate the relationship between neighbourhood contexts and health. I will now turn to the wider field as a way of better understanding the social fragmentation literature and to consider new approaches that may be of value to the development of the index and analyses, and their interpretation.

2.2 Beyond the “Black Box”; Emerging Issues in Neighbourhoods and Health Research

Much of the work presented in the social fragmentation review above has concentrated on examining the associations between characteristics of place and health. While most of the studies have necessarily been observational and cross-sectional in design, they have provided researchers with valuable information about important risk factors. In 2004 an interesting debate took place within epidemiology over the value of “risk factor” or “black box” research. Greenland et al (2004) took the position that developing a body of descriptive empirical work that identifies risk factors for health is an important part of the wider research process as it provides a foundation for the development and testing of hypotheses. They argued that in such research the onus should be on ensuring that associations are precise and replicable in order to be useable for developing good theory.

Others agree that making observations in the absence of substantive theory can be useful, but have taken a more cautious approach (Mayo and Spanos, 2004, Weiss, 2004). While care should be taken in how risk factor type associations are presented and interpreted, Weiss (2004) argued that variation in individual health outcomes across populations is in itself a phenomenon worth observing, even in the absence of hypotheses.

Mayo and Spanos (2004) clarified the need to ensure that empirical tests of hypotheses using observational data were a “reliable and severe probe of the ways in

which the hypothesis could be wrong" (Mayo and Spanos, 2004, p.524). Using a crossword metaphor, Haack argued that empirical evidence can fit together to complete a puzzle. The test is not necessarily in the quantity, but in how an observation (or crossword entry) is supported by other evidence and vice versa (Haack, 2004). As part of the same debate, Susser made a call for epidemiology to take a more complex approach to examining causes of disease in populations. Using a more sophisticated eco-epidemiology framework, it was argued, would encourage epidemiology to look beyond single causes, and move away from a research framework that is primarily focused on the identification of risk factors (Susser, 2004).

The 'black box' debate has been paralleled in the neighbourhoods and health research. Macintyre et al spoke of the "black box" as being a catchall for non-individual level factors, "...an unspecified miasma which somehow, but we do not know how, influences health, health-related behaviour or health risk in some population groups." (Macintyre et al., 2002, p.129). Rather than continuing to look for new and/or increasingly refined risk factors, the challenge has been made to develop research that illuminates the box (Macintyre et al., 2002). If this is to be achieved, other relationships must also be considered.

The unidirectional effect of place on health has perhaps been dominant in neighbourhoods and health research because it has been relatively easy to utilise available data in this way (Smith and Easterlow, 2005). Nevertheless within this 'exposure/outcome' framework important research questions continue to be raised about how an effect can and should be measured. For example, how are neighbourhoods and/or communities meaningfully and accurately measured (Kawachi and Subramanian, 2007); how are particular outcomes related to these measures (Galea and Ahern, 2006); and what populations are appropriate to observe effects (Diez Roux, 2002b).

Perhaps because of more limited data, there is less research that focuses on the reverse pathway between health and neighbourhoods (Smith, 2005). Commonly referred to as selection or drift effects, questions remain about how health status may be a driver for where individuals live. Consideration also needs to be given to understanding the compositional nature of neighbourhoods; what is the effect of individual health on neighbourhoods? How does the health status of individuals act as a determinant for the neighbourhood characteristics?

Another approach is to look at the processes between neighbourhood and individual health, for example, how residents use or don't use neighbourhood resources. Such research goes beyond looking for associations between a given exposure and outcome by attempting to observe why such relationships might exist. The review presented below has attempted to include research that has sought to address the many critiques faced by the field. The papers discussed have been selected for their contribution to the research field. They highlight many of the challenges faced, but also, more importantly, show direction and insight into what can be achieved with "good", illuminating research.

The first section considers papers that have suggested alternative ways of conceiving the "black box", and therefore the ways in which research can be conducted. Some papers offer new ways of framing or defining the "neighbourhood" as something other than a risk factor. Other papers focus our attention on the mechanisms and processes that go on within and around neighbourhoods.

The second section turns to methodological matters; how do we translate the conceptualisation of neighbourhoods and health discussed above into illuminating research? That is, how do we use the research tools available to us to better see into

the “black box”? Here the discussion turns to papers that have recommendations on how best to proceed; both what should be observed and how best to observe.

2.2.1 What is the “Black Box”? The Framing or Definitions of Neighbourhood

“Neighbourhood” has been conceived in the literature in a number of interesting ways other than a “risk factor” type exposure. Two useful ways of framing ‘neighbourhood’ were observed in the literature that had important implications for how research can be conducted. Firstly, neighbourhood can be constructed as a site containing resources (Attree, 2004, Bernard et al., 2007, Carpiano, 2006). Secondly, neighbourhood can be regarded as a place, geographical or otherwise, where people do things.

The potential of neighbourhoods to act as a source of resources for residents was highlighted in a number of papers (Attree, 2004, Bernard et al., 2007, Carpiano, 2006). Research of this nature asks about the production and quality of the resources, and also about differential access to resources. Attree (2004) regarded neighbourhoods as a place where social resources of varying quality are more or less available to children. The qualitative literature on children’s experiences of living in poverty was reviewed, asking “what resources are available to support children and young people living in disadvantaged circumstances?” (Attree, 2004, p. 680).

Neighbourhoods were framed as one of a number of potential social resource domains, alongside the family and friendships. The conclusion from the review was that children living in poverty were more dependent on available neighbourhood resources to buffer the effects of household poverty, but also that they were less able to escape a poorly resourced local environment because of the costs involved in travel to other places, entry fees and so on: “poverty made these resources crucial and compromised their value” (Attree, 2004, p. 686).

Bernard et al (2007) also regarded the geographical neighbourhood as a collection of health-related resources and relationships shared by all residents. They were interested in the extent to which residents are able to utilise such resources, which has implications for the production of health inequalities (Bernard et al., 2007). They suggest a conceptual framework by which researchers can consider rules which determine access to these resources, across various domains.

Research that has taken a neighbourhood resource approach has enabled researchers to consider how health-related resources might be produced within the neighbourhood setting. Carpiano (2006) employed Bourdieu's social capital theory to propose that neighbourhoods can usefully be framed as sites where collective resources are produced and consumed. Under this framework neighbourhood was constructed as an institution with a "stock or quantity of resources" (Carpiano, 2006, p.167) (that is, social capital) with benefits more or less obtainable for its residents. Research can then examine both the production of the resources within a neighbourhood and also by whom and how they are consumed (Carpiano, 2006).

Other papers have framed the neighbourhood as places where practices or everyday activities occur. The everyday travel practices of families was used as a way of drawing a 'picture' of the neighbourhood (Mathews et al., 2005). Geo-ethnography attempts to map the everyday journeys of residents as a means of measuring the "neighbourhood" - its boundaries and resources, as well as how it is used (Mathews et al., 2005). Observing daily journey practices allowed the researchers to examine the contextual resources that were actually available to and utilised by the families. They found that census tracts, commonly used to define neighbourhood boundaries, bore little resemblance to the resources and social networks utilised by the families observed. The authors concluded that "neighbourhood" may be better measured and defined by where people go and what they do (Mathews et al., 2005).

Some authors have examined the overlap between local spaces and social places by examining what residents do and where they do it. Examining the effect of local resources on the social lives of residents enabled Baum and Palmer (2002) to frame the neighbourhood as a site of “opportunity structures” for the health-related activities of residents. Looking at the effect of ‘walkability’ on walking and therefore social interaction between residents, feelings of sense of community and so on, du Toit et al (2007) found mixed evidence for an effect of the environment on the practices of residents. While they found that walking for transport was associated with neighbourhood walkability, it was walking for recreation that was associated with residents’ sense of community (du Toit et al., 2007).

Gatrell et al (2004) also drew on Bourdieu when examining how practices could be used to visualise ‘real’ social spaces. They argued that the social spaces, and the practices that construct them, need to be observed as much as the traditional geographical spaces in order to further our understanding of how people are able to access resources and generally live their lives. They went further to consider the extent to which social space corresponded with geographical spaces, and how this varied for different populations (Gatrell et al., 2004).

Others have argued that practices should not be seen as individual actions but rather as responses to the local social context. Frohlich, et al (2001) referred to them as social practices that comprise a lifestyle. Calling on social practice theory, they proposed that what people do arises from their context, and at the same time recursively transforms that context. In this conceptualisation ‘neighbourhood’ is framed as a geographic context where collective lifestyles are practised by residents; “Collective lifestyles are defined here not just as the behaviours that people engage in, but rather, as the relationship between people's social conditions and their social practices.” (Frohlich et al., 2001, p. 785).

The geographical nature of the neighbourhood is at times assumed in the neighbourhoods and health literature and therefore not clearly conceptualised (Cummins et al., 2007). Perhaps in response to this there has been a shift towards a more relational approach which challenges research to consider neighbourhoods as primarily social spaces (Cummins et al., 2007). However, there is also a risk in setting up a false dichotomy between geographical and social definitions of neighbourhood. As argued by Gatrell "...we have not yet presided over the death of distance. Territory and a sense of identity with particular places still matters." (Gatrell, 2005, p.2669). A number of authors have attempted to unpack the specific role played by geography by looking at proximity in the lives of residents (Galster, 2001, Gatrell, 2005), the geographical concentration of population groups (Cummins et al., 2007), and the differences between geographically bound social institution of the neighbourhood and other social institutions such as schools (Roosa et al., 2003).

The extent to which neighbourhoods are primarily geographical or social spaces remains a point of debate. Roosa (2003) suggested that the geographical nature of neighbourhoods provides a sense of common interest which is different but comparable to other social institutions such as school communities. Others point to the shared nature of geography. For example, Cohen highlighted that neighbourhoods act as a daily exposure that is common to all residents (Cohen et al., 2008).

2.2.2 Mechanisms and Processes: Between Individuals and their Neighbourhood; within and between Neighbourhoods.

The mechanisms and processes that go on within neighbourhoods – the 'how' of the neighbourhood -health relationship has produced some interesting work in recent years. Researchers have variously considered how people interact with the neighbourhood; are sorted and sifted into neighbourhoods; and the recursive nature of processes within the neighbourhood.

A number of authors have discussed the various ways in which people interact with features, or resources, of their neighbourhood. Cockerham (2005) proposed that we observe how the lifestyle “choices” of individuals are enabled or constrained by the structures present in the neighbourhood. Geographical neighbourhoods are one set of structural living conditions that set limits on the possible health-related lifestyle choices open to individuals. Thus, living in disadvantaged neighbourhoods could severely constrain the possibilities open to people, when compared to those living in more affluent areas. However, Cockerham also argued that observing agency, or the self-determination exhibited by individuals, was equally important in understanding how neighbourhoods are related to healthy lifestyles (Cockerham, 2005). In other words, the extent to which neighbourhoods structure the lives of individuals is only one part of the equation.

As discussed above, Attree (2004) and Bernard et al (2007) and Carpiano (Carpiano, 2006) saw neighbourhoods as a source of, or set of resources. But they did not regard them as being equally available or beneficial to all residents. In order to understand the role of neighbourhood resources, they observed that it was necessary to understand the role they play in resident’s lives. For example, local resources could potentially act as a buffer against poverty. Children living in disadvantaged households could benefit from their ‘richer’ neighbourhood resources only if they were able to access them (Attree, 2004). While Bernard et al (2007) conceived neighbourhoods as a set of positive and negative resources, it was understanding the access rules that was crucial to understanding why neighbourhood might influence health.

Frohlich et al (2001) and Cockerham (2005) argued that what individuals do is partly a response to the collective practices of the neighbourhood – the practices of those around them. For example, individual smoking practices are in part structured by features such as local policies on advertising, points of sale etc, but also on the

practices of other individuals in the neighbourhood. Frohlich et al (2001) used the example of illicit trading in response to restrictions on tobacco sales to youth by others in their community which in turn establishes a 'collective lifestyle' of underage smoking.

A number of papers regarded the characteristics of a neighbourhood as a reflection of ongoing processes. Rather than just focusing on the effect of place on health, a number of authors have suggested that research needs to better observe a more complete cycle of influence. Smith and Easterlow (2005) were interested in how people came to be living in particular neighbourhoods and the consequences therefore on the composition on the neighbourhood and individuals. They argued that often people move into a new neighbourhood as a result of a change in circumstance (such as illness) and so neighbourhoods are created as more or less healthy places through this compositional sorting and sifting.

Their work is of interest for the emphasis on the lifestyle and economic immigration of individuals, bringing a sense of a trajectory for both neighbourhoods and residents. It has also highlighted that neighbourhood characteristics can be determined by the movement in and out of areas by more and less healthy people. Their work has posed challenging questions about neighbourhoods as well as individuals: are some neighbourhoods kept more or less healthy by the way in which society is structured? Does a lack of care by society mean that illness can result in an individual being sorted into a less affluent neighbourhood?

Gleeson et al (1998) were interested in how neighbourhoods came to be places where mental health services, and those who used them, were clustered together. They argued that historical processes needed to be understood before conclusions could be reached on the spatial patterns of services and illness. For example, land use regulation and the property market were important local factors in determining how

services came to be clustered within an area, and how they interact with other factors to continue shaping the neighbourhood (Gleeson et al., 1998). Once services are provided in certain areas, what does this mean for who lives where?

Cockerham (2005) Macintyre et al (2002), Bernard (2007) and Frohlich (2001) were similarly interested in examining the recursive nature of the processes between the structural aspects of neighbourhood and the practices of residents; "Place cannot influence social practices without groups of people who are influencing place through their social practices." (Frohlich et al., 2001, p. 792). They argue that it is not enough to observe the effect of structures on individual practices, but that we need to observe how the process of everyday activities feeds back into the nature of the structures themselves, and then sets up new conditions for practices and so on. For example, the built environment can be seen as a reflection of accumulated social practices of a community, which in turn goes on to influence the current practices of residents, and so it goes on. It is the examination of this feedback process that can shed new light on the nature of neighbourhoods and the complex relationship with health (Cummins et al., 2007).

Finally, when considering how "neighbourhood" might influence health, there is a need to step back and reflect on how the related constructs of "neighbourhood" "community" and "place" come to be important in today's world. It is not only researchers who are interested in investigating the potential effects of the neighbourhood: it has also become an important part of the policy discourse in many countries (Whitehead, 2003). Neighbourhoods have become a common platform for administering state level interventions but the assumptions about the neighbourhood are often not explored, with implications for the effectiveness of such interventions (Chiu and West, 2007, du Toit et al., 2007, Jack, 2005). Understanding more about the discourses around neighbourhood remains, perhaps, a less commonly investigated challenge for research.

2.2.3 What should be Observed: Pathways, Systems, Effects?

The following two sections examine literature which raises questions about the “how” of neighbourhoods research, what should be observed and how best to observe it. A consistent theme in the publications is a move away from the search for a definitive “neighbourhood” exposure. Rather there is a call for more sophisticated conceptualisation, measurement and analytical processes. Accordingly, challenges are being put to the field to develop new data sources and analytical techniques. Three themes emerge in the literature; the need for conceptual development, the geographic nature of neighbourhoods, and the processes that occur between individuals and neighbourhoods.

A consistent theme in many publications was the need for conceptual development to drive what should be observed. It has to be said that unfortunately this is not a new theme in the literature! Among many others, Mujahid et al (2007), Frohlich et al (2004) Roosa et al (2003) and Frohlich (2007) have all argued that how the exposure is defined, measured and analysed needs to be determined by the conceptual model employed. Galea and Ahern (2006) discuss the risks and limitation to research posed when epidemiologists look for associations without asking first “why such associations should exist and why specific factors would cause particular diseases” (p 1079).

Roosa et al (2003) were concerned with a paucity of neighbourhoods research that could be utilised by scientists to develop effective intervention programmes for children. They argued that they were hampered by research which focused on neighbourhood risk factors rather than more proximal factors that might act as trigger processes that lead to poor outcomes. For example, parenting styles might be an important intermediary factor in explaining relationships between deprivation and child outcomes (Roosa et al., 2003). A transactional conceptual model was

presented that allowed the researchers to explore such mediating and/or moderating processes at play.

The fraught and heavily contested field of social capital research has similarly benefited as researchers have focused on defining the mechanisms they want to observe. For example, Kawachi (2006) and Frohlich (2004) demonstrated how alternative conceptualisations of social capital will have different pathways to health, and therefore require different means of measurement.

The continued call for research based on conceptual models does not negate the need for exploratory and innovative research. But it does suggest that such research can best be utilised when it can be set against theory. Exploratory results still need to be interpreted in some way and can be more valuable when they highlight contradictions, or alternative hypotheses, both of which can only be done when there is a conceptualisation of what has been observed. An excess of exploration without a sound theoretical base leads researchers to rely on inductive reasoning, with the potential to contribute to confusion rather than to illuminate (Frohlich et al., 2007) Frohlich gave the example of research around income inequality that has prioritised the finding of statistical associations (and the accompanying post hoc explanations) rather than developing and investigating mechanisms which might explain the observed patterns (Frohlich et al., 2007).

A primary emphasis in neighbourhoods and health research has been to focus on examining one domain of where people live their lives. There is increasing recognition that allocating people to a single contextual exposure fails to take into account how people live their lives. In attempting to understand what a “true” neighbourhood could be, Kawachi and Subramaniam (2007) recommend refocusing on how individuals can be members of multiple environments, both simultaneously and across the life course. Such an approach would need to take into account mobility between neighbourhoods, and the relative importance of non-

residential contexts such as work place settings or other communities such as churches or peer groups. Observing where people travel for everyday activities (Mathews et al., 2005), shop for food (Inagami et al., 2007), and interact socially (Johnson et al., 2005) were examples of research that specifically explores how and therefore where people live. But as well as looking at multiple exposures, Diez-Roux challenges us to consider the degree of dependence on neighbourhood exposures; who is advantaged because they can escape their neighbourhood (Diez Roux, 2003)?

The scale of neighbourhood is frequently discussed in the literature as an important methodological issue. However the question remains, what scale? The consensus seems to be that there should be no consensus! (Cummins et al., 2007). A number of authors have argued for the importance of clear conceptual models to determine the scale of the measured neighbourhood, as well as the processes that are to be observed for the particular research question and context at hand. For example, Roosa et al (2003) proposed that the scale of neighbourhood for mothers of little children would be different from that of adolescents. O'Campo similarly argued that multiple definitions of 'neighbourhood' may be required within a single study, depending on the outcome and populations being examined (O'Campo, 2003).

As well as research that acknowledges variable spatial scales, the interaction within and between different scales of context is another complicating feature that is now being incorporated into research. Rather than treating the neighbourhood as an independent unit, a number of authors recommend that study designs need to incorporate the interdependence between neighbourhoods (Riva et al., 2007). In a similar way, neighbourhoods themselves are located within other contexts, all of which may interact to create locally specific effects (Cummins et al., 2007, Cummins and Macintyre, 2006, Galster, 2003, Jack, 2005, Lake and Townshend, 2006, Merlo and Chaix, 2006)

Cummins and Macintyre (2006) highlighted contradictions in the international findings around food environments and obesity. Rather than regarding the contradiction as a problem they saw such evidence as informative. They proposed that the differences observed between the US and the UK may be due to supra-neighbourhood environmental mechanisms that are not captured in the data. For example, societal processes such as racial segregation and land values may explain differences in the distribution of supermarkets across deprived neighbourhoods. Challenging researchers to move beyond the assumptions of the 'Local Trap', Cummins (Cummins, 2007a) suggested differences in findings may be because neighbourhoods research has often been limited to available data on administratively defined small local areas, without reference to these wider social processes.

Research in New Zealand that has examined locational access to health-related community resources have shown contradictory patterns to many of those observed elsewhere. For example, deprived neighbourhoods generally had better access to health-related community resources (Pearce et al., 2007). Furthermore, access to health-related resources such as fruit and vegetable outlets and parks were generally not found to be associated with health outcomes such as fruit and vegetable consumption (Pearce et al., 2008) or levels of physical activity (paper under review). Pearce and colleagues have argued that the lack of an association may be because of pro-equity measures that have historically allocated such resources to more deprived areas and that without these policies health inequalities could be even greater in New Zealand (Pearce et al., 2007).

Similarly, international differences in findings on the health effects of social capital can be used to reveal characteristics of nations as well as the meaning of social capital (Islam et al., 2006). Rather than looking for evidence of global effects, which are assumed to be generalizable, more insight may be gained by comparing different

results and attempting to understand the more local processes that may be driving them.

In highlighting continuing gaps in the neighbourhoods and health research agenda, Kawachi and Subramanian (2007) report that the mechanisms by which neighbourhood disadvantage influences health continue to be under-explored. They are not alone in making this observation (Browning and Cagney, 2003). However, finding ways of observing and quantifying those mechanisms does not appear to be an easy task.

In a review of UK community programs for children and their families living in disadvantaged areas in the UK, Jack (2005) concluded that successful interventions were difficult to design, implement and evaluate effectively. He concluded that this was, to a large degree, because of the interrelationships between individual and neighbourhood levels of poverty and because community programmes "...usually involve so many different individuals, groups and organisations, each subject to an array of potential influences within changing social, economic and political contexts." (p.293). Continuing to focus on individuals and their families, or solely on communities, ignores the processes between them that lead to continued disadvantage. As discussed above, Roosa et al (2003) highlighted the benefits to intervention by focusing on capturing more proximal processes between neighbourhood characteristics and individual outcomes. For example, asking if parenting practices vary with neighbourhood deprivation may shed light on potentially mediating processes between developmental outcomes and disadvantage.

Galster (2003) also drew attention to neighbourhood processes. Drawing on a holistic framework, he gives examples of proxies of intra- and extra-neighbourhood processes that can be observed. Intra-neighbourhood processes – the social relations between neighbours – can potentially be measured with proxies such as social

control, networks, participation, resources etc. Extra neighbourhood processes – how those outside of the neighbourhood relate to it – can be captured with the measurement of stigmatisation, perceptions of external employers, ties of residents beyond the neighbourhood and so on. The authors argue that examining such processes encourages researchers to explore aspects that have traditionally been defined as positive or negative in a more dynamic way.

Complexity theory has become more common in the neighbourhoods literature, both explicitly (Diez Roux, 2007, Merlo and Chaix, 2006) and when authors promote the consideration of system features such as interaction effects, dynamics, non-linear and endogenous effects. While a number of authors have argued that the complexity paradigm has important implications for the field, Gatrell (2005) suggests some caution. In his opinion, the interest in the metaphors and theories offered by complexity has been slow to translate into empirical work that truly captures the paradigm. Nevertheless, it is clearly signalled in the literature as an important development, if only because of the challenges it makes to the field.

In such an approach, the limitations of regarding the neighbourhood as a single entity in space and time are now being recognised. Rather, 'neighbourhoods' or contexts are described as multifactorial and multilevel, as in the conceptualisation of the obesogenic environment (Lake and Townshend, 2006). Lake and Townsend make the point that research should attempt to capture how individuals interact with and respond to specific features in their multiple contexts, instead of viewing neighbourhoods as presenting various degrees of health risk for all residents.

2.2.4 How Best to Capture Neighbourhood Effects

Having considered what should be captured by research, we next need to consider how best to achieve this successfully. There were a number of clear directions in the recent literature that link the conceptual aims discussed above with practical ways

forward for research. One of the overriding themes in the literature reviewed here is that there is no single method that can do the job. Instead, a number of methods or ways of capturing effects are promoted throughout the literature.

Measuring the “neighbourhood” still remains a fundamental challenge to future research (Cummins et al., 2005b, Kawachi and Subramanian, 2007, Messer, 2007): “Thinking carefully about how ‘context’ can be defined, measured and represented at an individual level over time and in social and physical space still remains a challenging, but necessary task, in order to truly understand ‘contextual’ effects on health” (Cummins, 2007a, p. 356). The availability of data and methods for measuring neighbourhoods has increased substantially in recent times, but as Frohlich et al (2007) point out, it is not always clear what should be done with it. As they and a number of authors have repeatedly stated, ‘what’ about the neighbourhood, and how it should be measured needs to be determined by clear conceptual models (Cummins et al., 2005b, Frohlich et al., 2007, Kawachi and Subramanian, 2007).

Readily available administrative data sources have been critiqued for their inability to tap into aspects of the neighbourhood that have been theorised to be related to health (Cummins et al., 2005b, Frohlich et al., 2007, Mujahid et al., 2007) Instead, it has been proposed that measures of neighbourhood characteristics should attempt to operationalize specific health-related domains or constructs of the neighbourhood context. Pearce and colleagues (Pearce et al., 2006), for example, developed five domains (health care provision, food stores, recreation facilities, educational facilities and marae (Māori community gathering place)). The domains were then used, with various degrees of success, to drive data collection from multiple, national level sources across New Zealand (Pearce et al., 2006).

Cummins et al (2005a) recommended that multiple data sources be used to find variables that best operationalize the domains. While they recognise the many problems associated with mixed types of data, they argue that the added information provides researchers with more effective and meaningful tools. Another consequence of using multiple sources was the more robust operationalisation of the constructs theorized to be important neighbourhood factors. A reliance on single, readily available data would have hindered this (Cummins et al., 2005b). Obviously compromises are needed, particularly when trying to develop meaningful measures that can be used at a national level (Pearce et al., 2006).

A single definition of 'neighbourhood', either the scale or the characteristic, is no longer regarded as appropriate (Galster, 2001) and more than one measure may be required within a single study (O'Campo, 2003). O'Campo also raised the point that boundaries of neighbourhoods will need to be specific to the outcome and population being studied. Other researchers have focused on the methodological difficulties of creating boundaries that are meaningful to residents. In part this is to avoid the Modifiable Area Unit Problem (MAUP) where associations have been seen to vary according to the scale or boundaries used (Flowerdew et al., 2008). In response to this, researchers are developing techniques such as zone designs that will allow for more accurate estimates of local boundaries than the commonly used administrative areas (Cockings and Martin, 2005, Haynes et al., 2007). Other research has followed residents' movements, arguing that the neighbourhood boundaries should better reflect people's actual lives (Mathews et al., 2005).

Another set of research discusses methods for capturing the processes between neighbourhood contexts and health. A feature of many of the papers reviewed here is the shift away from examining a direct effect of a generic risk factor on the health of the general population. This has meant that researchers have needed to utilise a

range of study designs and techniques to examine processes discussed above, both quantitative and qualitative.

Rather than observing the whole population level, it has been suggested that research may be more effective when specific populations are targeted (Diez Roux, 2002b). Work that focused on the relationship between children's health and neighbourhoods in particular has been able to reveal different mechanisms and insights for this population when compared to the general population (Jack, 2005, Roosa et al., 2003). While this means that the findings of any specific population will not be generalizable to the whole population (which is not necessarily always an appropriate aim), it does increase our understandings of how neighbourhoods work, which is then still directly relevant to a more general setting.

Originally developed in the education research to examine school and classroom effects, multilevel modelling techniques have provided statistical methods for examining clustered data. Being able to simultaneously use data on individual and neighbourhood level factors in a regression has had many implications for the research questions able to be addressed. For example, it has meant that potential confounding by individual factors of the neighbourhood level exposure could now be controlled for, addressing the sociological fallacy as seen in O'Reilly et al's multilevel suicide study (2008). Multilevel methods have been used to differentiate between individual factors and other sources of risk, such as household risk factors, neighbourhood level risk factors (Cubbin et al., 2000), or larger aggregations such as states. Similarly, cross-level effects could be examined of the relationship between a neighbourhood level exposure and outcome individual level (Oakes, 2004). Interactions between neighbourhood and individual characteristics can be just as informative as independent associations (Fagg et al., 2008).

At a statistical level, the non-independence of the data could now be included in the regression model without violating the statistical assumptions. Rather than being a statistical nuisance and source of bias, the degree of clustering itself could also be observed as a substantive research question (Merlo et al., 2005). Researchers could now partition the amount of variation in outcomes to that between individuals and between neighbourhoods. It was argued that this partitioning could allow researchers to determine if neighbours were more like each other than residents of other neighbourhoods. If all the variation could be explained by individual differences then the neighbourhood variation could be considered to be due to a compositional effect. On the other hand, if neighbours were more alike, it could be considered as evidence of a contextual effect.

Arguments continue within the literature as to whether distinctions should be made between context and compositional effects or whether a false dichotomy has been created (Macintyre et al., 2002, Riva et al., 2007). One possible implication of a lack of evidence for a contextual effect is that neighbourhoods don't matter. If any observed neighbourhood variation can be explained away by a certain aggregation of individuals, then any intervention should be targeted at the individuals rather than places. Instead, the compositional nature of neighbourhoods has highlighted the importance of selection processes of residents into neighbourhoods (Merlo and Chaix, 2006, Oakes, 2004). Returning to the point raised above, residents may share important characteristics for complex reasons that require observation.

Some authors have argued that because increased awareness of processes such as selection, some standard epidemiological methods are no longer valid (Oakes, 2004). In particular, Oakes has used factors such as selection and life course to argue that individuals cannot be regarded as 'exchangeable'. The multiple factors that lead to one person living in a highly deprived neighbourhood at a given point in time makes that person too different from someone living in an affluent setting, even if they have

comparable income and education (for example). The interpretation of a regression analysis is dependent on the statistical assumptions that an individual in one type of neighbourhood is exchangeable with an individual in another type of neighbourhood, once measured confounding factors have been controlled for. That is, there is no residual confounding within strata, and individuals are completely exchangeable between exposure levels. It is well recognised that adjustment cannot perfectly account for all the differences between individuals.

No doubt the argument around the importance of exchangeability for understanding neighbourhood effects will continue. An upside to debates such as these has been the way they have pushed the research field to explore new methodologies. Oakes (Oakes, 2004) has recommended the use of randomized control trials and more recently, matching by neighbourhoods (Oakes et al., 2007). Other possible solutions proposed to the exchangeability 'problem' have been propensity scores (Diez Roux et al., 2004) and instrumental variables (Kawachi and Subramanian, 2007). Both seek to approximate the counterfactual, whereby confounding of the exposure/outcome association is completely controlled.

Papers have also called for a greater variety in the kinds of effects observed in studies. Rather than prioritising direct linear effects, some authors are calling for study designs that explicitly seek to examine nonlinear effects, feedback loops, contagion, tipping points, and mediation and moderation effects in order to observe the processes discussed above (Galster, 2003, O'Campo, 2003, Roosa et al., 2003, Smith and Easterlow, 2005). Other kinds of effects have moved from being regarded as nuisance sources of bias to being of substantive interest, such as endogeneity and selection effects, and therefore require study designs that explicitly observe them (Frank et al., 2007, Galster, 2003, Smith and Easterlow, 2005).

As well as observing different populations and effects, research that uses a variety of techniques is recommended. Correspondence analysis allows the patterns of association between factors to be visually represented in scatter plots (Gatrell et al., 2004). It has been promoted as one statistical technique that can incorporate a complex approach to quantitative analysis (Cockerham, 2005, Gatrell et al., 2004) but to date appears to have been infrequently utilised in the literature. Concept mapping, another visual mapping technique, was used to develop understanding of how neighbourhood domains, such as community resources, may perpetuate violence (O'Campo et al., 2005). Narrative techniques have also been promoted as an effective means of observing the complexity of neighbourhood life, which can then contribute to the wider picture (Uprichard and Byrne, 2006). Other papers report multiple methods within a single study, for example geo-ethnography (Mathews et al., 2005).

Noted above was the need to observe the effect of time in studies of neighbourhoods and health. This can be achieved in a variety of ways, depending on what aspect of time is important. Longitudinal studies with neighbourhood measures can observe individual's movement in and out of neighbourhood environments, and changes in health associated with that movement (or stability) (Diez Roux et al., 2007, Kawachi and Subramanian, 2007). Another alternative is to consider how places change, with consequences for residents (Boyle et al., 2004). A number of papers recommend developing an historical perspective in understanding how places come to be as they are, and people's relationship to them (Ben-Shlomo, 2005, O'Campo, 2003, Gleeson et al., 1998).

Another way of reframing the individual is to consider how the same neighbourhood resource may mean different things to individuals. Rather than treating all residents as equally exposed to a resource, Carpiano (2007) and Webber et al (2007) examined

how differences in the access to and utilisation of a local resource may be important for understanding health variation.

As well as refocusing on how we conceive and measure neighbourhoods, there is also a need to reconsider how the individual is framed by researchers. While no researcher would actually consider individuals to only be exposed to their local administratively defined residential neighbourhood, this is actually how a great deal of published work is conducted. Generally, the discussion sections of papers will recognise this anomaly as a limitation of the reported study, but more recently some studies have sought to address this problem. As reported above, Matthews et al (2008) used techniques to observe how individuals crossed boundaries and were therefore able to measure their exposure to a number of settings. Kawachi and Subramanian (2007) recommended that studies should be designed to observe multiple membership of contexts by weighting individuals' exposure to different neighbourhoods or environments, either cross-sectional or across the lifecourse.

2.2.5 Future Research Directions

The literature presented has been perhaps less reliant on 'new' solutions or methods than in the past. A pessimistic interpretation could be that this is due to a lack of imagination in the field, or that the field has reached its limits. The range and depth to the research field evident in the literature above would strongly contradict that interpretation. More realistically, the imbalance hopefully represents a shift towards recognition of the importance of theory for good research, rather than the continued focus on just developing better methods. It may also reflect recognition of the desire to use multiple methods to address complex problems in the field. It seems that researchers are turning to other disciplines or combinations of disciplines, such as geo-ethnography, as a means of moving forward. Such a mixed approach will no doubt be fraught as methods don't always translate well. Perhaps one of the biggest

challenges faced by the field is in communicating findings across such a wide set of disciplines and methodologies.

A common theme to a number of papers is the need to consider information from a number of sources if we are to understand how neighbourhoods might be related to health – research needs to actively develop joined up evidence (Petticrew et al., 2005). As discussed above one of the strengths of the field is its cross disciplinary nature. However, unless researchers are able to firstly access and then make sense of studies from other sectors, this advantage becomes a hurdle. Coordination between research groups and between complementary disciplines is required to develop a set of studies that complement each other's data sources, analytical techniques, populations, settings and so on.

The body of work reviewed above represents a collection of important themes for the neighbourhoods and health research field. A number of overriding messages are clear if the field is to make substantial progress in understanding how neighbourhoods might influence the lives and therefore the health of individuals. The importance of theory and conceptual development in the questions asked, and the design, implementation and interpretation of studies can no longer be dismissed as being of secondary importance. In the same way that individuals are not regarded as independent, neighbourhoods need to be framed as interrelated units. The complexity of space needs to be incorporated into scales of neighbourhood and the contexts within and beyond it. The relationship between neighbourhood and health is more sophisticated than can be captured by a unidirectional pathway. Observing interactions between individuals and their neighbourhoods and between neighbourhoods and their wider contexts allows the systemic nature of contexts to be revealed.

2.2.6 Conclusion: Implications for this Thesis

The literature investigating the relationship between neighbourhood level social fragmentation and health has largely been restricted to a single measure of fragmentation, the Congdon Index. A wider variety of outcomes have been used in recent times, but the focus has remained primarily on mental health outcomes. There has been little evidence of a relationship with non-mental health outcomes.

Increasingly sophisticated research questions and methods have been employed, suggesting that researchers are attempting to move beyond a risk factor approach. However there is still little explicit discussion in the literature of what 'social fragmentation' is; how it relates to the measure used, and why and how it might therefore be related for health. Important questions remain about whether indices such as the Congdon are capturing a social property of the neighbourhood which might be important for health, or whether the suicide and mental health findings are a consequence of wider 'sorting and sifting' processes.

The review of the wider neighbourhoods and health literature highlighted the many challenges and opportunities faced by the field. Obviously many of the issues raised above are beyond the scope of this thesis, or indeed an entire neighbourhoods and health research programme. Nevertheless the review has highlighted that investigating the social fragmentation/health relationship would provide the opportunity to address a number of the challenges raised. While some factors such as time processes are not able to be examined with the cross-sectional data available here, its importance can still be recognised. For example, regarding endogeneity as an important neighbourhood process can have consequences for the interpretation of cross-sectional analyses.

Investigating the cross-sectional, multilevel association between social fragmentation and health can be a useful case study of the issues raised above. The process of developing the measure of fragmentation and its utilization in analyses can be

developed in the context of conceptual models. Specific pathways can be examined to shed light on whether neighbourhoods might act as a social resource for individuals. Differences in the importance of fragmentation for sub populations can be investigated. Rather than investigating neighbourhood-level social fragmentation as simply a risk factor, the emphasis can then be turned to understanding what is meant by social fragmentation and why it might matter for health as an important research question in its own right.

The following chapter seeks to address the first point by developing a conceptual model of neighbourhood social collectiveness. The model was used to drive the operationalisation of the conceptual model with administrative data, thus creating a theoretically grounded index. Chapter Four addresses the risk factor critique by going on to explore why and how the index might be related to health. Two specific mechanisms are developed that might explain the potential relationship between neighbourhood fragmentation and health. Translating the mechanisms into observable pathways using a social epidemiological framework is discussed in Chapter Five. The analyses that follow are therefore firmly grounded in theory and have been carefully designed to illuminate specific fragmentation/health mechanisms. The discussion in Chapter Eight brings the index, the theory and the analyses together, to consider the empirical support for the proposed mechanisms, but also the extent to which the analytical process has been able to shed light on the relationship between the neighbourhood and individual health.

Chapter 3

The Index of Neighbourhood Social Fragmentation - Creating an Illuminating Measure

The social fragmentation and background neighbourhoods literature reviewed in Chapter Two emphasised the need to develop a theoretically grounded measure of neighbourhood-level social fragmentation. Firstly, there was a lack of clarity in the social fragmentation literature about why the Congdon index might theoretically be related to the health outcomes tested. And secondly there was the need to understand what it was about the small areas, or 'neighbourhoods', that was captured by the administrative data used to create the index (Cummins et al., 2005a, Frohlich et al., 2007, Kawachi and Subramanian, 2007). The work presented below is a direct response to that critique, seeking to develop an 'illuminating' measure of neighbourhood social fragmentation by bringing theory and data together.

As signalled in the introductory chapter, the index was created early in the thesis because of project constraints. This was therefore before a substantive review of either the theoretical literature on neighbourhood social properties or Durkheim's work. Instead the index was grounded in the literature described in the previous chapter and the project parameters. In particular, the starting point was the Congdon index, the administratively defined geographic neighbourhood, and the prescribed statistical methods.

The chapter has therefore focused on the development of a conceptual model of social fragmentation and its subsequent measurement. The process by which this was achieved is summarized in Figure 3:1. The chapter begins with a description of the methodological parameters for the measurement of social fragmentation in New Zealand. Rather than acting simply as constraints, they proved to be highly informative for the development of a conceptual model of neighbourhood

fragmentation. Operating within these parameters, the process of deciding how indicators of fragmentation could be selected is then discussed.

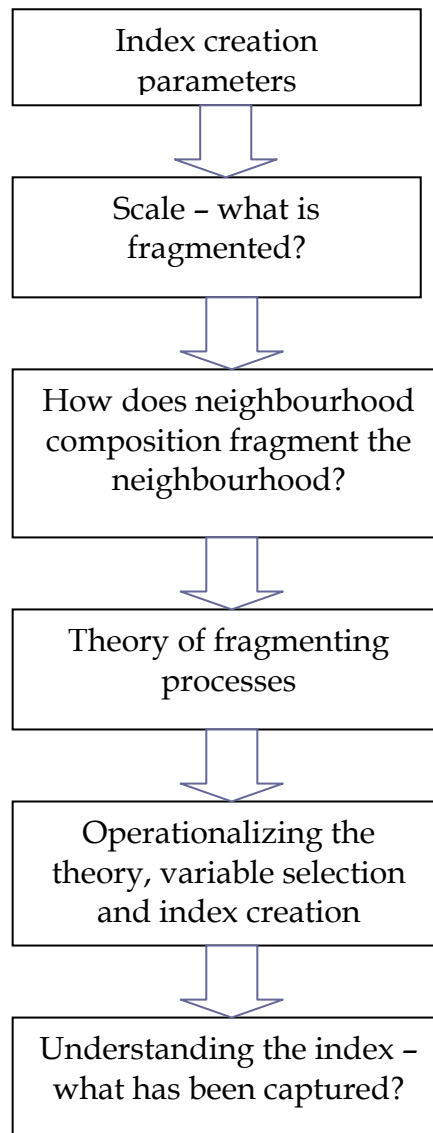


Figure 3:1: Creating the Index of Neighbourhood Fragmentation

The next section of the chapter describes how a conceptual model of neighbourhood social fragmentation was developed. The process of moving from theory to data is demonstrated in the operationalisation of the three fragmenting domains and the

creation of the index. The resulting Index of Neighbourhood Social Fragmentation (NeighFrag) is described and compared to a New Zealand version of the Congdon index (Congdon(NZ)). The reliability and validity of the index is examined by exploration of its temporal and geographical distribution and also its ecological relationship with other neighbourhood characteristics. Further understanding of the index for use in analyses is gained by examination of the distribution of individuals by NeighFrag and other factors. The chapter concludes with a discussion of what is now known about neighbourhood social fragmentation, both the construct and the measure.

3.1 The Index Creation Parameters

As noted above the index was part of a wider project creating measures of health-related neighbourhood characteristics. The social fragmentation index was developed by a team including myself, Clare Salmond, a biostatistician, and June Atkinson, data manager and analyst. I was responsible for the theoretical development, operationalisation with variables, and interpretation of the index. All decisions were made as a team, with each area of expertise contributing as appropriate.

Prior to my involvement in the project four important parameters were established for the development of the index. Whilst the parameters were limiting, it also provided useful constraints, given the vast array of measurement and theoretical possibilities. Firstly, the conceptualisation of the index began with the example set by Congdon's index of social fragmentation (Congdon, 1996b). As discussed above, Congdon's work and the subsequent use of the index has provided the ground work for understanding what could be captured in such an index and why it might be related to individual health. There was limited guidance in the literature about what is meant by the term "social fragmentation", but generally the work is part of a wider

research field that includes constructs of social capital and cohesion, collective efficacy, social disorganisation, and so on.

Secondly, based on earlier readings, it was intended that the index would be different but related to neighbourhood measures of deprivation and social capital which had already been developed. Congdon had earlier established that the social fragmentation construct was not the same as social disorganisation, which combines deprivation and informal social control type measures (Congdon, 2004a). A theoretical relationship between the social fragmentation and 'social cohesion' constructs had been established in the literature, although it remained unclear whether fragmentation was simply the inverse. Further, there was little explicit explanation as to why an aggregation of the individual characteristics captured by the Congdon index would be related to the social resources of a neighbourhood. The considered development of a New Zealand index was therefore an opportunity to examine the relationships between the various measures and the constructs, helping to shed more light on how neighbourhoods might be important for health.

Thirdly, the data sets determined both the scale of measurement and the level of the data available to create the measure. The index sought to measure the neighbourhood at a specific scale, the census area unit (CAU). CAU's are defined by Statistics New Zealand as "...non-administrative areas that are in between meshblocks and territorial authorities in size...Each area unit must be a single geographic entity with a unique name referring to a geographical feature. Area units of main or secondary urban areas generally coincide with suburbs or parts thereof." (Statistics New Zealand, n.d.-b). Area Units are therefore the closest available official unit to a small natural community. CAU's are reviewed at each census to make sure that they continue to reflect actual geographic neighbourhoods. The population range from 2,000 up to approximately 5000 (Statistics New Zealand, n.d.-b)

The index was created using individual and household level census data from the 1996 and 2001 New Zealand national census datasets (Statistics New Zealand, 2007a, Statistics New Zealand, 2007b). Only variables that were available from census data could be included in the dataset. Factors such as population density would have required adding geographic data to the census records, a more complicated process outside of the scope of the project. Essentially, this meant that the index was restricted to capturing the population composition of a neighbourhood. A consequence of using a single data source was the inability to address the recommendation of Cummins et al (2005a) for the utilisation of multiple data sources. Nevertheless, the comprehensive nature of the census datasets gave considerable scope for the range of variables available.

And finally, the index was to be created using the same methods employed previously for NZDep: Factor Analysis (FA) and Principal Components Analysis (PCA) (Salmond et al., 1998). The method provided the opportunity to understand more about what the index might be capturing, rather than just using all the variables that might be available. While the Congdon index has been used as a summary index elsewhere, we created a weighted version of the Congdon index to better compare with our index of fragmentation.

3.2 How to Select Indicators of Neighbourhood Social Fragmentation?

The first task was deciding how to select census indicators of 'social fragmentation'. It has to be noted that an acceptable and obvious course would have been to use New Zealand versions of the four Congdon variables: that is, single person households, marital status, private rentals and residential mobility. However a more challenging (and interesting) course was taken in order to better understand the measure. The search for alternative and additional indicators proved to be informative.

Congdon and others have recommended that alternative indicators of social fragmentation needed to be explored (Congdon, 2004a, Stjarne et al., 2004). The New Zealand census was a comparatively rich source of individual information and could therefore provide a good opportunity to source alternatives. The use of FA and PCA also prompted exploration of alternative indicators. But questions remained about what it was that the combination of the four variables in the Congdon index might be measuring and therefore what other variables should be sought. The process of seeking and assessing other indicators was therefore a valuable way of gaining insight into the Congdon measure.

The review of the general neighbourhoods and health literature highlighted the need to clearly conceptualise and define the construct that is being measured. As noted, a lack of explicit conceptual development of the construct and the measure was evident in many of the social fragmentation papers. The need for conceptual development is increased when using sources such as census data to develop proxy measures of theoretical constructs and mechanisms, or what is known in statistical terms as latent variables (Frohlich et al., 2007). For example, Pickett and Pearl (2001) observed that “proxies are used for complex measures that we intuitively understand but cannot measure with accuracy...” (p.116). Understanding how the proxy variables obtained from secondary data sources relate to the construct of interest was therefore an important challenge faced in developing a neighbourhood measure of social fragmentation.

As a means of improving the validity of such measures, Frohlich et al (2007) proposed that researchers clearly state how they have arrived at a variable, starting with the underlying theory. They used a deductive approach going from ‘grand’ to ‘substantive theory’, then to ‘construct’, down to ‘indicator’ and finally ‘item’ (the actual variable used from a dataset). They argue that too often meanings for measures are applied retrospectively, limiting the value of empirical research. By

necessity, a more iterative process was employed here, going from the development of a definition, to potential indicators, to observable variables, with each stage informing the next and increasing understanding of the former stages. Nevertheless, the principle was the same; to develop an understanding of the concepts beyond the variables used to operationalize them, in order to create a more valid measure.

An important factor in selecting indicators was to understand what is fragmented. On reading the wider literature around the construct it became apparent that understanding the scale, or site, of social fragmentation was necessary to understand the exposure. Fragmentation of a unit has been considered at a variety of scales, from families (Thorlindsson and Bjarnason, 1998) to nations (Cutright and Fernquist, 2000). As the focus has already been established in this thesis to be at the neighbourhood scale the next step was to consider what kind of process could be captured that might reflect the degree of fragmentation of the neighbourhood.

Another common use of fragmentation in the literature has focused on capturing evidence of individuals' integration into societal level institutions. For example, lower levels of legal marriage have been used as a marker of less integration into the social institution of marriage (Fernquist, 2007). Therefore consideration was given to capturing aggregations of individuals who were less integrated into mainstream societal institutions such as legal marriage or religion. However the range, quality and validity of social institution indicators available in the census was limited, and largely restricted to the mainstream culture of New Zealand's multi-cultural society. For example it would not be able to reliably capture integration into other social institutions such as marae (Māori community gathering place), or church groups. Thus, a measure which relied on the limited range of social institutions in the census would increase the risk of misclassifying individuals, and therefore neighbourhoods, as less integrated.

Finally, census data was only collected from individuals and households. Therefore no information was available which could inform us of the types of relationships that existed across or within the neighbourhood. Census questions were not able to directly measure the level of fragmentation of the social ties and institutions within the neighbourhood itself. The scope was similarly limited for examining the relationship between an individual and their locality, with the arguable exception of long term residency. Therefore census data could not provide direct information on the level of integration of individuals to their neighbourhood. It was also not possible to take into account how non-compositional factors might also contribute to fragment neighbourhood, for example, features of the built environment.

Thus it was unclear what the relationship was between the Congdon index and its component variables, and the construct of social fragmentation. The question remained - what was broken, and how were these variables part of the fragmenting process? The answer to this question evolved after examining how the Congdon variables and others that were similar were used in the literature. The social fragmentation of a neighbourhood measured the structural antecedents to the social collectiveness of a neighbourhood. That is to say, the variables used in the Congdon index appear to be related to the ability of a neighbourhood to act collectively. A fragmented neighbourhood would be one where the collectivity might be reduced because the antecedent conditions made it more difficult in some way. A model was then developed to describe three factors, or domains that contribute to the collectivity of a neighbourhood which could then be operationalized with variables from the census data.

3.2.1 Towards a Theoretical Model of Collective Social Functioning

The neighbourhood and health and suicide literature was examined for the use of the four Congdon variables: marital status, single person households, private rentals, and residential mobility. Attention was given to how the variables were utilised in

the analyses. It was noticeable that in much of the literature, variables such as single person households or marital status were used in analyses with little explanation. Most commonly they were used as confounders, or covariates, to analyses that examined the relationships between individual health outcomes and some sort of social group status or property. Often they were included in the analyses because they were associated with the group social processes in some way. For example, high residential mobility has been linked to low levels of collective efficacy (Duncan et al., 2003).

Other authors explicitly referred to the Congdon type variables as being antecedents to a collective process, such as collective efficacy. Sampson and Groves (1989), for example, hypothesised that high levels of residential mobility in a neighbourhood acted as a structural barrier to the kinds of local social ties needed to control neighbourhood-level problems such as delinquency. Attention was also given to other variables which were commonly used alongside the four Congdon variables and in similar ways. For example, in the social disorganization and collective efficacy literature the level of immigrant populations within a neighbourhood is often included as a marker of a barrier to communication across the neighbourhood. The polarising effect of income inequalities across sections of society are also seen as disrupting communication within a social setting (Forrest and Kearns, 2001).

A common theme evolved from the literature. Gracia et al (1995) used the term 'macro social determinants' to describe how the characteristics of areas or social institutions were important to understand the production of social support within them. Frequently the Congdon type variables were used in analyses as predictors of, or antecedents to, the production of neighbourhood social resources and processes such as collective efficacy or social capital. This use of neighbourhood compositional features has resonance with Durkheim's 'social substratum', where he argued that "...the constitution of this substratum directly or indirectly affects all social

phenomena..." (Durkheim, 2003, p. 77). It implies that there might be certain neighbourhood level inhibitors for the production of 'collective social functioning' because of the characteristics of the neighbourhood population (Macintyre et al., 2002).

Underlying the literature on 'collective social functioning' was the sense that communities are able to act as collectives when certain factors are in place. These factors act as the structural antecedents to 'collective social functioning' for the neighbourhood. For example, it has been argued that factors such as mobility affect the development of the close networks required for cohesion (Fagg et al., 2008). Yen and Syme (1999) recognized the importance of capturing such processes, summarizing that "...there are features of areas that strengthen or weaken social support and cohesion, and these have important implications for the health of residents in those areas." (Yen and Syme, 1999, p. 203).

In a similar way, my conclusion from considering the type and use of variables presented in the literature was that the factors they captured the local social topography which underlies the construction of social ties and institutions: they do not make them, but provide a context within which they are made and therefore will have some effect on their construction and maintenance. The presence of these fragmenting characteristics may make social ties and institutions within the neighbourhood more difficult to establish and maintain than in areas with fewer of those characteristics.

Fragmenting Domains

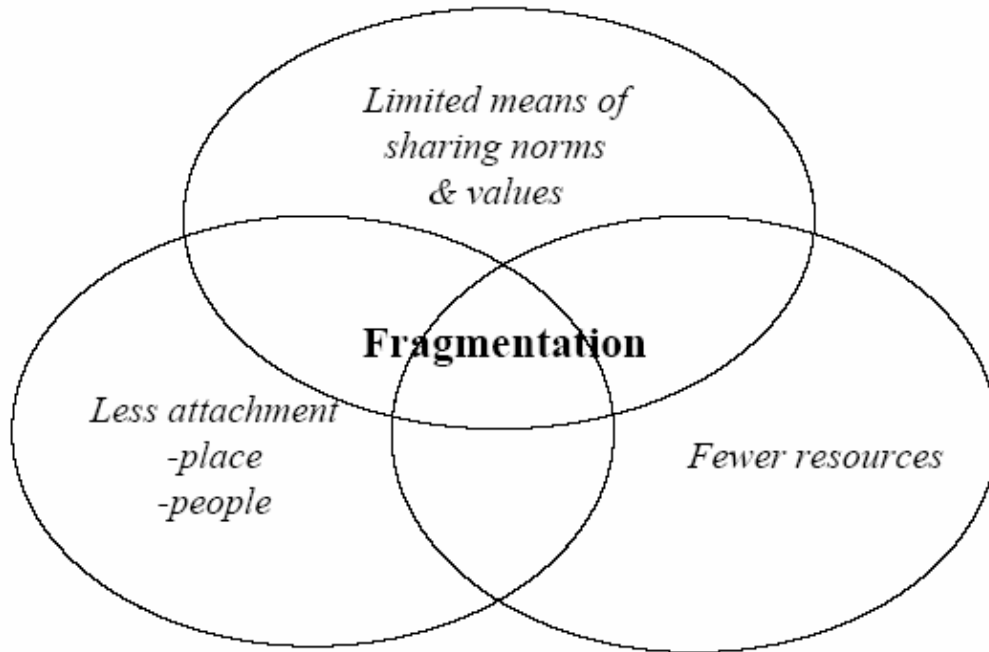


Figure 3:2: Fragmentation of Neighbourhood Collective Social Functioning

Based on the literature, three domains were determined as being important for the level of collectivity within a neighbourhood: attachment to people and place; a means of communicating norms and values across the neighbourhood; and neighbourhood social resources. Paucity within the neighbourhood in these domains - low levels of attachment, limited means of sharing of common norms and values, and low levels of resources - could fragment the neighbourhood social environment, because it could inhibit the ability of the neighbourhood to function as a social collective. Figure 3:2 illustrates the joint contribution of the domains to the fragmentation of the collective social functioning of a neighbourhood. Each domain is discussed in more detail below, along with possible indicators that could be sourced from census data.

3.2.1.1 Attachment

The importance of attachment for the processes of social integration and cohesion has been noted by a number of authors (Forrest and Kearns, 2001, Berkman and Glass, 2000, Berkman et al., 2000). Attachment to place generally has been operationalized by measures of population mobility and home tenure, either by ownership or renting. High levels of population turnover are judged to weaken the ability of a neighbourhood to develop and sustain social networks and controls because of the time needed to develop such ties (Forrest and Kearns, 2001, Lindstrom et al., 2002, Martikainen et al., 2003 , Winstanley et al., 2002).

Likewise, household tenure is seen as a measure of commitment to an area (Winstanley et al., 2002). Franzizni and Spears (2003) observed that household ownership facilitated residents' participation in activities that will benefit the local neighbourhood, such as voting, civic action and volunteering. Lindstrom et al (2003) reasoned that the financial investment in a property and its area encourages the social investment in maintaining a well functioning community.

Personal attachments are generally operationalized with measures such as marital status and household composition. While there have been calls to 'update' measures to reflect changing norms about co-habitation (Congdon, 2004a, Stjarne et al., 2004), legal marital status has consistently been associated with increased mortality and morbidity, suggesting that the two variables may be different (Greenfield et al., 2002, Lorant et al., 2005, van Os et al., 2000, Watson, 1995).

Relationships beyond marriage itself have also been shown to be significant for levels of social integration. For example, becoming a parent has been demonstrated to increase the levels of social integration of adults, particularly with school-aged children (Nomaguchi and Milkie, 2003). The presence of family ties has been shown to increase the assistance given to others, regardless of kin ties (Gallagher and

Gerstel, 2001). On the other hand, living alone has generally been associated with less social participation (Lindstrom et al., 2002) and poorer health outcomes of those individuals (Law et al., 2005).

3.2.1.2 Means of Sharing Norms and Values

Groups require the means to communicate values and norms that to some extent are common across the community. Forrest and Kearns (2001) emphasized the importance of shared values and interaction for a sense of social cohesion and that without them “a society lacking cohesion would be one which displayed social disorder and conflict, disparate moral values, extreme social inequality, low levels of social interaction between and within communities and low levels of place attachment” (Forrest and Kearns, 2001 p 2128).

The ability to communicate readily within a neighbourhood has been established as important for neighbourhood functioning (Sampson and Groves, 1989). In the collective efficacy literature, shared languages are seen as important to removing communication difficulties (Sampson et al., 1999). Problems with communication, for example not sharing a common language, can lead to difficulties accessing information, which has been theorised as being important for health (Cummins et al., 2005a). In a similar way, the proportion of recent immigrants is often seen as a measure of a variety of cultural values being present in a neighbourhood, and therefore potentially a challenge to the sharing of norms and values (Sampson et al., 1999) (It is important to note here that cultural diversity is not seen as a fragmenting factor per se, but only when cultural factors impede communication between subgroups: there are other means of facilitating communication or common interests that can override cultural and language barriers).

Another means of facilitating cross-neighbourhood communication would be having interests and values common amongst residents. However, finding variables that

might capture a neighbourhood common interest in census data was highly problematic. A very interesting example of the importance of a common interest is a study on pet ownership. Owning a pet has been shown to be related to increased levels of social networks and interaction because the process of dog walking provides opportunities to interact with other local dog owners (Wood et al., 2005, Wood et al., 2007). Unfortunately pets were not included in the census.

An alternative common interest that was available in the census was the presence of children in a neighbourhood. There is much research demonstrating the positive effect of children on the social networks (Nomaguchi and Milkie, 2003) and volunteering activities of parents (Wilson and Musick, 1998). The density of children in a neighbourhood could therefore represent an interest that can become neighbourhood wide. While individual beliefs about children will vary, they can provide common grounds to, for example, push for better recreational facilities or roading infrastructure.

There is certainly evidence in the literature for children acting as a common interest that could facilitate the sharing of norms and values within a collective. Work in this area has considered the impact of children on social capital, networks, participation, volunteering and so on. Sampson et al (1999) argued that a higher number of children in a neighbourhood would reflect the "child-centered nature of neighbourhood life" (Sampson et al., 1999). Nomaguchi and Milke (2003) observed that the presence of children had an integrating effect on adults, not just through increased opportunities but also through shared interests with other parents. It seems that adults generally benefit from the social contact associated with children's activities, in particular those of school age (Gallagher and Gerstel, 2001). Therefore a lower proportion of children in a neighbourhood may then be one observable factor in low levels of cross-community communication. In the absence of other

compensating measures, having a lower proportion of children in a neighbourhood could be a fragmenting mechanism.

Opposite to common interests were potential polarizing factors within a neighbourhood that could decrease the sharing of norms and values across a neighbourhood. Forrest and Kearns considered “social solidarity and reductions in wealth inequalities” (Forrest and Kearns, 2001 p 2129) to be a potentially polarizing process. They considered that a lack of inequality within a group would promote shared norms and values and therefore social cohesion in a group. Alternatively, polarisation caused by inequalities could hinder the sharing of common norms and values, fragmenting the group (Forrest and Kearns, 2001).

3.2.1.3 Resources

As well as considering why and how communities function as social groups it is worth considering the resources available to support neighbourhood social networks. Because census data was being used the emphasis needed to be on the social resources; who was available. There was little direct discussion of this in the literature but it is implied in some work on volunteering. For example, it has been observed that women’s contribution to caring and volunteering reduces with formal employment because of added time constraints (Gerstel and Gallagher, 1994, Hook, 2004). Therefore, the social networks of a neighbourhood may be jeopardised by low levels of individuals who are able to support these networks. McPherson asked who was available in communities to do the volunteering, concluding that changing employment patterns was one factor which was impacting on the part played by women (often mothers or caregivers) in volunteering roles (McPherson, 2004).

Long term residence has also been associated with increased local ties (Forrest and Kearns, 2001, Parkes and Kearns, 2006). Neighbourhoods with high proportions of

residents who have lived there for long periods may be advantaged by their ties and commitment to the community, as well as any institutional knowledge.

The literature has suggested that a number of factors are important for the collective social functioning of a neighbourhood. These factors have been summarized as the structural antecedents to collectivity: attachment, the means of sharing norms and values, and social resources. The variables used in the Congdon index and others related to them may act as fragmenting factors because of their potential to hinder collectivity within the neighbourhood. The next challenge was to create an index that logically operationalized the conceptual model using administrative data.

3.3 Methods

The statistical methods used to create the index are described below. As this is a social epidemiology thesis rather than a biostatistical one, the emphasis is accordingly on describing how the methods align with the theory.

3.3.1 Dataset

Two datasets, 1996 and 2001 were developed from census data by Statistics New Zealand. Datasets that included the variables required to operationalize the model presented above were provided to our research team in Statistics New Zealand's secure data laboratory. All counts have been random rounded to maintain confidentiality in accordance with Statistics New Zealand requirements.

The 1996 and 2001 Statistics New Zealand census datasets included a total number of 3,618,300 and 3,737,280 people, respectively, living in 1775 CAU's.

3.3.2 Measurement Units

New Zealand has three main levels of geographical classification; meshblocks, area units and territorial authority. Meshblocks are the smallest geographical units which are aggregated to make up area units (described above) and then to territorial authorities. Geographical areas are also further defined as urban or rural. The 1996 census was categorized using a five point scale: urban areas were classified as main, secondary or minor, and rural areas were defined as 'rural centres' and 'other'. The classification was extended to seven points in 2001; main urban areas, satellite urban areas, independent urban areas, rural areas with high, moderate, or low urban influence, and highly rural or remote areas (Statistics New Zealand, 2008).

3.3.3 Who and What Should Be Included?

Careful consideration was given to defining the population for use in creating the index. Who contributes to neighbourhood collective functioning? In particular, thought was given to residents living in different types of dwelling. Common practice has been to use individuals who classify themselves as usually resident in a household, and who are living in private dwellings (Hawton et al., 2001, Salmond and Crampton, 2002). Restricting to this population excludes residents who lived in non-private dwellings. It was felt that this would lead to an undercounting of areas where there was a higher proportion of people usually resident in non-private temporary or institutional type dwelling, such as hostels, boarding houses and so on. Exploratory counts by territorial authority revealed considerable variation across authorities in, for example, individuals counted as usually resident in motor camps.

The inclusion of non-private dwellers was therefore critical to measuring the fragmenting composition of neighbourhoods. As the index was attempting to capture neighbourhoods that had lower levels of attachment, such neighbourhoods would be more likely to have fewer people in private dwellings. It may be that people resident in these areas live in hostels because that type of accommodation is

more predominant there, or that they may seek more transient dwelling types because of lifecycle stage.

It was therefore decided to include all dwelling types that could be considered a part of the local community. Prisons, police lockups, hospitals - public and private and youth camps were excluded. Dwelling types now included private dwellings; marae; residential homes for the elderly; "holiday" type accommodation such as holiday homes, motels, hotels, motor camps, boarding and guest houses; institutions such as university, educational, welfare, religious and charitable hostels; occupational accommodation such as defence force housing, work camps and seasonal housing. Also included were homeless dwellings such as night shelters, "no fixed abode" and rough sleepers.

Area units were restricted to those with a population over 100 people, for two reasons. As a rule the values obtained for very small numbers would not be reliable for use in correlations. Also, the use of sparsely populated areas could potentially jeopardize the confidentiality requirements of Statistics New Zealand when using mortality and morbidity data. Following restrictions due to residency a total of 3,596,085 (1996) and 3,720,723 (2001) observations were used to create proportions for 1635 CAU's.

3.3.4 Operationalizing the Domains: Finding Indicators

Census questionnaires were examined for variables that could operationalize each of the three domains as fully as possible, based on the literature described above. Because the index would be analyzed in regression with models that included NZDep and because fragmentation was theorized to be related but different from deprivation, care was taken to avoid variables that were used in that index (means tested benefits, employment equivalised households income, access to a telephone, access to a car, single parent family, qualifications, home ownership, household

overcrowding). An exception was made for household tenure as it is important for both constructs. A version was created without tenure so that sensitivity tests could determine the implications of its retention in the index.

Following Frohlich et al's (2007) example, the logical process of moving from the domain construct to the actual measurable variable is summarized in Table 3:1. On the left hand column are the three domains that contribute to social fragmentation. The middle column lists the possible indicators for each domain suggested from the literature. The final column on the right hand side lists what was able to be observed in the census datasets. Some variables were trialled in a number of ways, for example 'children' was trialled as 'preschool' (0-4 years) and 'school aged' (5-14 years). While some variables directly match the census questions others, such as 'At home parents', were derived from a number of questions.

Table 3:1: Potential indicators of neighbourhood social fragmentation

| Domains for Fragmented Neighbourhood Functioning | Potential Indicators Available in NZ Census | Measurable Fragmenting Variables |
|--|---|---|
| <p>Little sharing of norms and values across the neighbourhood</p> | <p>1 Common interests: - children - culture - absence of polarisation</p> <p>2 Ease of communication (common language)</p> | <p>1a <u>few children</u> 1b <u>high levels of recent immigrants</u> 1c <u>high income inequalities</u></p> <p>2 <u>high levels of non-English/Maori speakers</u></p> |
| <p>Low levels of attachment</p> <p>- to place</p> <p>- to people</p> | <p>3 Investment in the neighbourhood: - material (home ownership) - social (residential stability)</p> <p>4 Secure family relationships</p> | <p>3a <u>low levels of homeownership</u> 3b <u>high population turnover within one year</u></p> <p>4a <u>fewer married adults</u> 4b <u>high levels of non-family households</u> 4c <u>high levels of single-person households</u></p> |
| <p>Limited resources</p> <p>- time available to establish and maintain social ties and networks</p> <p>- historical and local knowledge</p> | <p>5 Social and economic structures that support individuals who perform such activities: - at-home parents - caregivers (for extended family) - Superannuitants</p> <p>6 Long term residents (15 years or more)</p> | <p>5a <u>lower levels of at home parents</u> 5b <u>lower levels of unpaid caregivers of elderly, ill or disabled</u> 5c <u>lower levels of healthy Superannuitants</u></p> <p>6 <u>fewer long-term residents</u></p> |

3.3.5 Variable Creation

The variables, a combination of individual and household levels, were then used to create the CAU proportions necessary for generating the index. Variables were coded to obtain a positive correlation with high fragmentation. That is, high proportions of recent immigrants, non-NZ language speakers, population mobility, renting, non-family and single person households, and income inequality for example were considered as positively correlated with fragmentation. The remaining variables were reverse coded to ensure that low proportions of children, at home parents, and so were also positively correlated with fragmentation.

Area proportions were created for each variable and observations with missing data were included in the denominator (and numerator if reverse coded). Including observations with missing data, for example, those with dwelling codes as 'hospital', aimed to reduce differences across areas in the proportion of missing data. Again, it was possible that missing data was unevenly distributed by fragmentation. A failure to take missing data into account could therefore have introduced potential misclassification of areas.

Four variables could be coded in alternative ways: 'children' could be defined as school-aged or 'under 5'; marital status could be legal or social; 'recent immigrants' could be within one or five years since they immigrated; and 'residential mobility' could be within one or five years. Years of 'long-term residency', which could be defined in many ways, were trialled as 5+, 10+, or 15+ years. Some alternative definitions of proportions in an area were discarded because their distribution was severely non-normal or had inadequate variability.

A simple income inequality variable was tested using household income. Creating a variable to examine income inequality within neighbourhoods was potentially a time consuming exercise. Therefore an approximation was created using the Jensen

equivalised household income to assess its potential place in the index. As it was not shown to be important in subsequent analyses, effort was not expended to create a more sophisticated measure such as the gini coefficient.

The abbreviated codes are given in brackets

Children; 0-4 years/5-15 years (Chn04/Chn515)

All children of the given ages usually resident in dwellings specified above.

Recent Immigrants; 1 year/5 years (RecImm1/RecImm5)

All usual residents born overseas who arrived in New Zealand less than 1 or less than 5 years ago.

Non New Zealand language speakers (NonNZLang)

All usual residents who indicated that they could not carry out a conversation in English or Māori (excluding those for whom language status was not relevant, such as babies).

At home parents (AtHomeParents)

Usually resident adults, living in a household with dependent children, who looked after children in their own households unpaid and who were not available for work, or worked or studied part time (<20 hours per week), and did not receive the sickness or invalids benefit.

Unpaid caregivers (UnpaidCarers)

Usually resident adults who looked after the elderly, ill or disabled unpaid and who were not available for work, or worked or studied part time (<20 hours per week), and did not receive the sickness or invalids benefit.

Superannuitants (1996; Healthy Superannuitants) (Superannuitants) (HlthySup)

Usually resident adults who received superannuation payments or veteran's benefit (and for 1996 who reported no health problems).

Long term residents (LongTermRes)

All usual residents who been living at their usual residence for 15 years or more on census night.

Population mobility; <1 year/5 years (PopMob0) (PopMob5)*

All usual residents who have lived at their usual residence for less than 1 year/5 years on census night.

Housing tenure; homeownership/rental/Private renting (HomeOwner) (Rental) (PrivRent)*

All households that were owned/rented/rented from a person or business or organisation other than the state or local council.

Marital status; legal/legal and social (includes cohabitating) (MarLeg) (MarLegSoc)*

All usual resident adults who were legally married/legally married or who have partner.

Non-family households (NonFamHH)

All households where the composition is of residents who were not related to one another (eg; flatmates).

Single person households (below 70 years) (SingPerHH)*

All households where the composition was a single person who is <70 years.

Income inequality (approx_InEq)

For exploratory purposes an approximation was created using Jensen equivalised household income to investigate variation in the range of incomes within CAU's.

3.3.6 Selecting Variables and Assigning Weights

Principal Components Analysis (PCA) and Factor Analysis (FA) were utilised for two exploratory purposes, one theoretical, and the other statistical. Firstly, a key theoretical question was whether the variables would group in similar ways to the theoretical model. In other words, to what extent could the particular variables accurately reflect the single overarching fragmentation construct, or the three specific domains, or was the relationship between the variables less easily defined? FA provided the most insight into this question.

A deeper understanding of the relationship of the variables with each other was also required. While there were clear theoretical grounds for including, for example,

school aged children in an index, it was important to examine its statistical relationship with the other variables as part of validating its inclusion or exclusion. FA provided a means of assessing the boundaries of the fragmentation construct, decreasing the chance that the index did not "...drift inadvertently into unintended domains" (DeVellis, 2003, p. 60).

The primary purpose of FA is to examine the relationship between a given set of variables and any underlying common factors (DeVellis, 2003). It can be used to confirm that a set of individual variables tap into a latent hypothesised construct, addressing the validity of an index. But it is also important to keep in mind that there is no guarantee that the latent variable is the same as the construct seeking to be measured, just that the variables are related in some way to each other in the dataset under examination (DeVellis, 2003).

Variable selection in the creation of an index should be parsimonious. A second statistical goal of the analysis was to ensure that only variables that contributed a significant amount of salient variation to the index be included. Thus, if a variable showed considerable variation, but did not appear to be related to the commonality of the others, it would be excluded. Alternatively, if a variable were related but only weakly, its inclusion would not add much to the index. Such a variable would act as a distorting influence as its variation is primarily unique to that variable. Principal Components Analysis and Factor Analysis would both be important in determining the best variables to retain.

Factor Analysis assesses the presence of a hypothetical, latent factor that is common to a number of variables (DeVellis, 2003). For example, given a starting number of 20 variables, perhaps only 12 have something in common with each other, that is, the latent factor. This 'commonness' is examined with the use of a correlation matrix that captures that covariation amongst variables. As there is only a hypothetical common

factor, the coefficients obtained can only be an estimate of any actual relationship between the variables.

Factor Analysis can also be used to reduce a large set of variables to a smaller one that more efficiently reflects the construct (DeVellis, 2003). FA seeks to partition the variation of the variables into that which is common to a hypothesised latent factor and that which is unique to the single variable. Factor Analysis was used to select only those variables whose variation was sufficiently correlated with the underlying latent construct(s) (Armitage and Colton, 1998). Variables whose covariation was not statistically related with the other variables could then be excluded. FA can therefore be used to reduce the number of variables in an index so that only those that contribute to the underlying latent construct were included.

As with Factor Analysis, Principal Components Analysis seeks to create a smaller number of composite variables, based on the variation of a larger number of individual variables. Principal Components Analysis is concerned chiefly with reducing a number of variables to the most 'efficient' level. In this instance 'efficiency' relates to the number of variables which account for most of the total variance observed amongst the original set of variables (Armitage and Colton, 1998).

Principal Components Analysis can be viewed as a reordering of a set of variables into groups. The first composite group (or component) contains the individual variables whose variation accounts for the most covariation. The subsequent components account for another set of variation that is not accounted for by the first and so on until all variation is accounted for. The aim is to have the first, or principal component, account for more variation than would be expected from the average single variable (Armitage and Colton, 1998). This sum of variation of each component is expressed by the eigenvalue.

Exploratory analysis of the underlying factor structure used a rotated factor pattern trialling both orthogonal and oblique rotation (the latter allowing for possible correlation between factors) (Armitage and Colton, 1998). Both methods were used when checking for a number of factors or components as it was thought to be likely that common factors or components would be related (note however that when the procedure is performed with only one factor no rotation is possible). The results were examined for; 1) scree plots of eigenvalues above 1 for sharp changes in values; 2) maximised proportion of variance accounted for; 3) factor loadings higher than 0.4, and 4) a simple factor structure, with variables only loading significantly onto one factor (DeVellis, 2003).

Principal Components Analysis was used to create a score based on the first principal component, reflecting the maximum variation of the variables selected by FA (Armitage and Colton, 1998). The score was used to create a weighted index. The procedure was repeated for both years and a New Zealand version of the Congdon index was also created for comparative purposes.

3.3.7 Assessing the Validity and Reliability of NeighFrag

There were limited means of assessing the reliability and validity of the index. Reliability, or consistency of the measure, was assessed with checks on stability between the two census datasets, as a form of test-retest reliability (Tuckman, 1988). Some change in the ranking of neighbourhoods might be expected over the two consecutive 5-yearly censuses, for example reflecting changing housing developments or area boundary changes. A comparison between the versions was used to assess alternate-form reliability (Tuckman, 1988). Once again, the versions were expected to be different, but not too divergent.

Assessing the validity of the index, that is the extent to which it measures the construct of interest (Tuckman, 1988), was also problematic. The concurrent validity

of the index would normally be assessed by comparing NeighFrag against an accepted gold standard (Tuckman, 1988). It was unknown whether the Congdon index could be considered the “gold” standard (indeed this was of substantive interest). Nevertheless, the Congdon provided a useful internationally recognized alternative standard. The results for the New Zealand and Congdon versions were compared in all evaluations.

The construct validity (Tuckman, 1988) of the index was assessed with comparisons between with sentinel knowledge of particular neighbourhoods in NZ, and from predicted relationships with two other area measures. A positive, but not strong correlation was expected with NZDep, an established ecological measure of socioeconomic deprivation created from the equivalent census using small-area proportions of no telephone access, no car access, in receipt of a means tested benefit, unemployment, low household income, single parent families, no qualifications, non-tenured homes; and household crowding (Salmond 1998 and 2002; Crampton 2000 and 2004). On the other hand a moderately negative relationship was expected with SoCInd, an ecological measure of social capital, created from the 1996 census on the neighbourhood proportions of formal volunteering (Blakely et al., 2006).

Further understanding of the index was sought by examining its ability to predict other ecological neighbourhood characteristics and the population distribution. While it was expected that, for example, the neighbourhood proportion of home owners would be predicted by the index, it was of interest to see whether non-index compositional characteristics would also vary by fragmentation, such as age and ethnicity. The construct validity was explored at the ecological level with the unit of analysis at the area unit level. Limited examination of the distribution of individuals by fragmentation was also undertaken. The primary purpose of the examination of was not for theoretical exploration but to better inform the analyses to follow.

SAS was used for all procedures. Version 8 was used for procedures in the Statistics New Zealand data laboratory (creating the correlation matrix, PCA, and investigating individual data) and version 9 for the factor analysis procedures and other investigations. The datasets were provided with the linked individual and neighbourhood data completed by the dataset holders (Statistics New Zealand). No dataset had information that could identify individuals to their actual residence, thereby maintaining the confidentiality of the participants. The census datasets with individual information could only be accessed at the Statistics NZ data laboratory. Information brought out of the laboratory was subject to checking procedures. All counts have been random rounded to a near multiple of 3 and care has been taken that no information is presented that could be used to identify individuals. ArcGIS 9.2 was used to create the maps.

3.4 Results

3.4.1 Selecting Variable Specification

An iterative process was used to select the variables and subsequently create the index. Firstly, all potential variables were included in PCA to create a correlation matrix and summary statistics using PROC PRINCOM. The results were used to determine which alternative specifications of the immigration, mobility and marital status variables should be retained.

For marital status, it was observed that MarLeg was slightly more highly correlated with the attachment variables than MarLegSoc. It was also observed that MarLeg has a slightly wider standard deviation across AU. There was limited statistical evidence for choosing between the two versions so the decision was made to use MarLeg to be consistent with the literature.

There was no similar pattern of correlation with other variables of the two levels of Chn, PopMob and ReImm. The versions were trialled in FA to determine which

specification contributed most to the latent variable. Higher factor loading values determined that Chn515, PopMob0 and ReImm5 would be retained.

HomeOwner and Rental were both very highly correlated and when each was separately removed little difference was observed in the factor loadings. Homeowner was retained, as it appeared to be less room for misclassification from the census questions and the data dictionary classifications. PrivRent was retained for use in the Congdon version only.

3.4.2 Factor Analysis and Principal Components Analysis

Factor Analysis was used to explore the structure of the three variables identified in Table 3:1. Both orthogonal rotation and oblique rotation methods were used as we did not want to assume that the factors would be uncorrelated. The results from PCA and FA were used to understand the factor structure of the remaining variables: could the covariation best be explained by a number of discrete factors (similar perhaps to the three domains) or a single latent factor? Eigenvalues of the first principal component were considerably larger than those for the second component (Table 3:2), supporting a strong underlying primary factor, although the factor analyses failed to confirm that more than one latent factor were present. In particular, school-aged children tended to have significant loadings across most factors. 'Attachment' variables formed the most persistent group loading on a single factor. However, FA trials using either orthogonal or oblique rotations failed to settle on a single factor loading pattern with more than one factor.

Table 3:2: Composition of the NeighFrag index and a New Zealand version of the Congdon index

| Domain | Proportion in the Area Unit of | Weight (Coefficient in First Principal Component) | |
|---|--|---|------|
| | | 1996 | 2001 |
| Less sharing of norms and values | 1a Fewer school aged children | 0.58 | 0.58 |
| | 1b More recent immigrants in previous year | 0.63 | 0.62 |
| | 2 More non-English/non-Maori language speakers | 0.42 | 0.41 |
| less attachment | 3a Less home ownership | 0.83 | 0.79 |
| | 3b More residential mobility within 1year | 0.91 | 0.87 |
| | 4a Fewer married adults | 0.72 | 0.74 |
| | 4b More non-family households | 0.78 | 0.76 |
| | 4c More single-person households | 0.42 | 0.41 |
| Fewer resources | 6 Fewer long term residents (15+ years) | 0.63 | 0.63 |
| <i>Statistics</i> | | | |
| <i>Proportion of total variance</i> | | 0.44 | 0.46 |
| <i>Eigenvalue of first principal component</i> | | 3.97 | 4.12 |
| <i>Eigenvalue of second principal component</i> | | 1.61 | 1.65 |
| CONGDON (NZ) | | 1996 | 2001 |
| | Private rentals | 0.87 | 0.89 |
| | Single person households | 0.63 | 0.61 |
| | Married adults | 0.77 | 0.83 |
| | Residential mobility within 1year | 0.82 | 0.83 |

When the number of factors was restricted to one, eight variables demonstrated substantial, positive loadings for both years. “Single-person households” was borderline for 2001 but just above the 0.40 threshold for 1996. However, given its common use in research, it was retained, giving a total of nine variables. The single factor structure remained when the various variable specifications were trialled, including an eight variable version without the household tenure variable.

PCA results confirmed these variable selections and the extraction of a single factor in both datasets. The final composition and weighting of the index is shown in Table 3:2. The particular linear combinations identified by these weighting coefficients accounted for 44 and 46 percent of the total variation in this set of variables for the two censuses. The four variables not included in the index were primarily in the ‘resources’ domain. It may be that they were less successful at operationalizing the underlying construct and were therefore not statistically related to the variation in the other variables. It could also be that there was insufficient variation in the area proportions of the variables to make a statistically significant contribution to the latent factor.

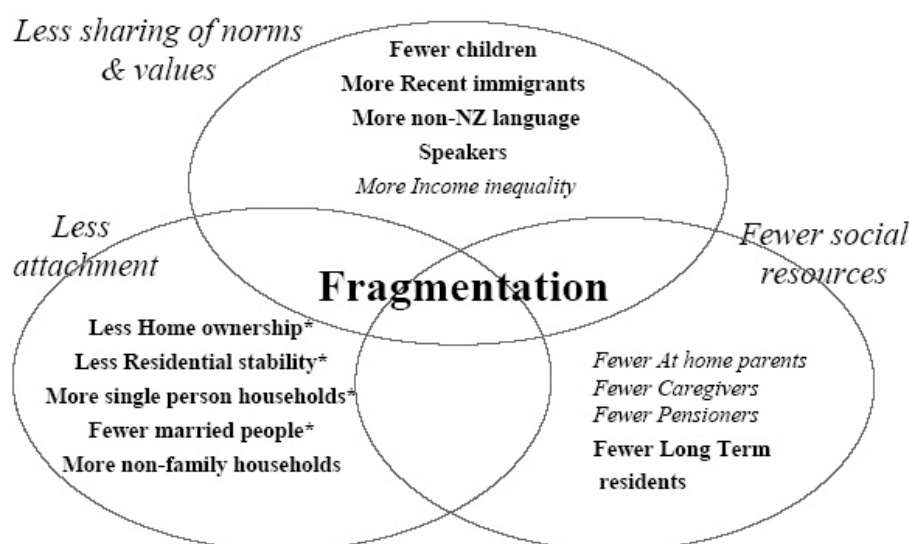


Figure 3:3: Fully operationalized Index of Neighbourhood Social Fragmentation
Although the four variables used to create a New Zealand version of the Congdon index would not ordinarily be subjected to PCA or FA (due to the small number of variables) it was observed that they did all load positively and significantly together as a single factor. Figure 3:3 illustrates the variables that remained in each domain (in bold), with those that were not included in italics. The Congdon type variables are highlighted with a *.

The Index of Neighbourhood Social Fragmentation (abbreviated to 'NeighFrag') was created as the score on the first principal component of the selected variables, which is the weighted linear combination of the variables' maximum variance. For ease of use in future analyses this was then converted into deciles, with decile 10 capturing neighbourhoods with the highest proportions of fragmenting characteristics. The same procedure was used for creating Congdon(NZ), a New Zealand version of the Congdon index.

3.4.3 The Indices

The composition and weightings from the first principal component for the NeighFrag and Congdon(NZ) versions for both censuses of the index are shown in Table 3:2. The weightings show reasonable consistency across both versions and across the two years. The eigenvalues for the Congdon(NZ) are not reported as the small number of variables makes them meaningless. The weightings, when compared to NeighFrag, placed considerably more importance on single person households and marital status but less importance on population mobility. While the tenure variable is not strictly comparable, more weighting is given in this index to the private rental than homeownership in NeighFrag.

To assess the role of the tenure variable a 'no tenure' version was compared to the full NeighFrag. The eigenvalues (not shown) suggested that omitting tenure resulted

in less covariation being captured by the index. In the absence of tenure, more weighting was assigned to school aged children and population mobility, and less to married adults and non NZ language speakers (to the point of questionable loadings). The results supported the decision to include household tenure in the index. There was little difference in the weightings but the full version had better eigenvalues. Subsequent checks (not reported) also confirmed that the relationship with NZDep was not dependent on the tenure variable, and that the two versions had similar geographical distributions and relationships with neighbourhood composition.

There is little change in most weightings across the two censuses for any of the versions. This suggested that the indicators were stable proxies for the underlying constructs they were measuring. A small decrease in the weightings for home ownership was accompanied by a decrease for population mobility. The 2001 eigenvalue for NeighFrag was larger than 1996.

The distribution of the raw scores of each version of the index is illustrated in Figure 3.4. In 1996 the scores ranged between 1.8 and 6.9 for the full NeighFrag; a slightly narrower range for the Congdon (NZ) (2.1 - 5.9). The no tenure version ranged from 1.7 to 7.1 (not shown). The range of the scores for 2001 were very similar and so will not be reported here. The highly negatively skewed distribution suggested that the index is capturing a 'lack', rather than a characteristic that is common to the population.

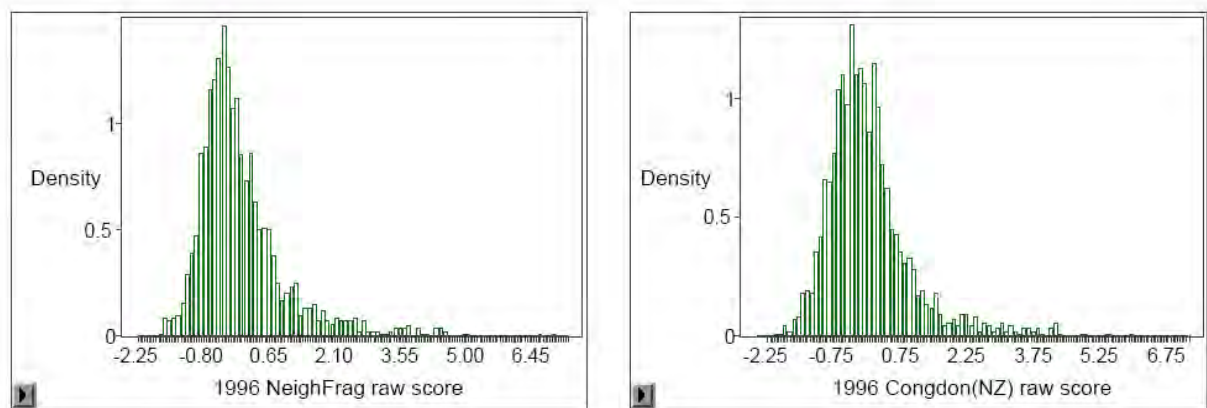


Figure 3:4: Distribution of 1996 NeighFrag and Congdon Raw Scores

3.5 Understanding the Index

3.5.1 Reliability and Validity: Ecological Relationships

The index was examined in a number of ways to increase our understanding of both the index and the construct we were attempting to measure, and to assess reliability and validity. Analysis first concentrated on the ecological relationships between area characteristics, such as urbanicity, deprivation and social capital, as well as other compositional factors. The relationship between neighbourhood fragmentation and individual characteristics was also explored to better understand the index and to establish important individual level factors for use in later analyses.

Face validity was first checked by observing the ratings for a selected group of known neighbourhoods. For example, those known to have highly transient student or tourist industry populations were expected to be rated as highly fragmented. Personal knowledge of the project team was reinforced by community profiles available from the Statistics New Zealand website (Statistics New Zealand, n.d.-a). Conversely, those known to be composed of primarily single building dwellings and stable family orientated areas were expected to be less fragmented. There were no unexplained contradictions between sentinel knowledge and the decile ratings.

The geographic distribution of NeighFrag deciles was first examined, for the country as a whole and then for selected urban and rural settings (Figures 3:5-7). The maps showed a range of values for area units across both main islands, and across rural and suburban areas. The pattern of distribution of deciles was roughly comparable between the NeighFrag and Congdon(NZ), with the Congdon(NZ) marking the east of the North Island and north west of the South Island as slightly more fragmented (Figure3:5). In general however, the centres of a population area, such as a small rural town or inner city area were ranked as more highly fragmented than the surrounding area. All inner city neighbourhoods in main centres, including those with large student populations, were amongst the most highly fragmented, as expected. The maps show the distribution of fragmentation deciles across New Zealand (Figure 3:5) and selected urban (Figure 3:6) and rural settings (Figure 3:7) in more detail.

Generally there was a good level of consistency across the two censuses with most areas retaining the same values or with only small changes in values. Some larger differences were observed. These were investigated and found to be due to, for example, boundary changes or areas with changing urban development. There was therefore good support for the reliability of the index across the two census periods. Examination of CAU's for NeighFrag values did not reveal any unexplained missing values or unexpected extreme anomalies (based on sentinel knowledge).

The ecological relationships between both versions and other available neighbourhood measures were explored to provide information for validity and to consider the implications for their use in analyses. Levels of fragmentation, as measured by the NeighFrag and Congdon(NZ) indexes, were moderately but negatively associated with low levels of volunteering, as measured by the SoCInd index (only available for 1996).

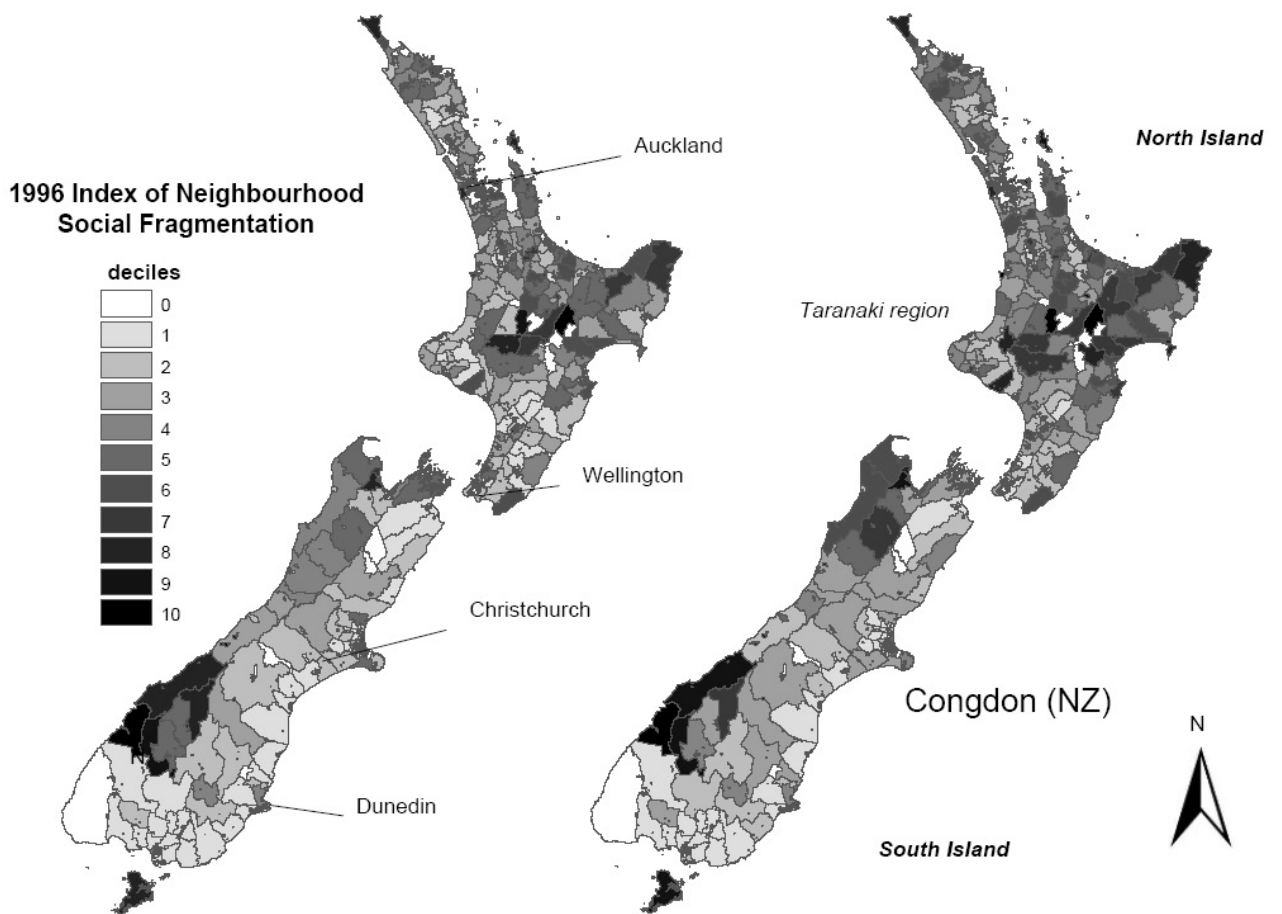


Figure 3:5: The 1996 Geographical Distribution of NeighFrag and Congdon(NZ) across New Zealand

0 = missing values, 1 = least fragmented, 10 = most fragmented

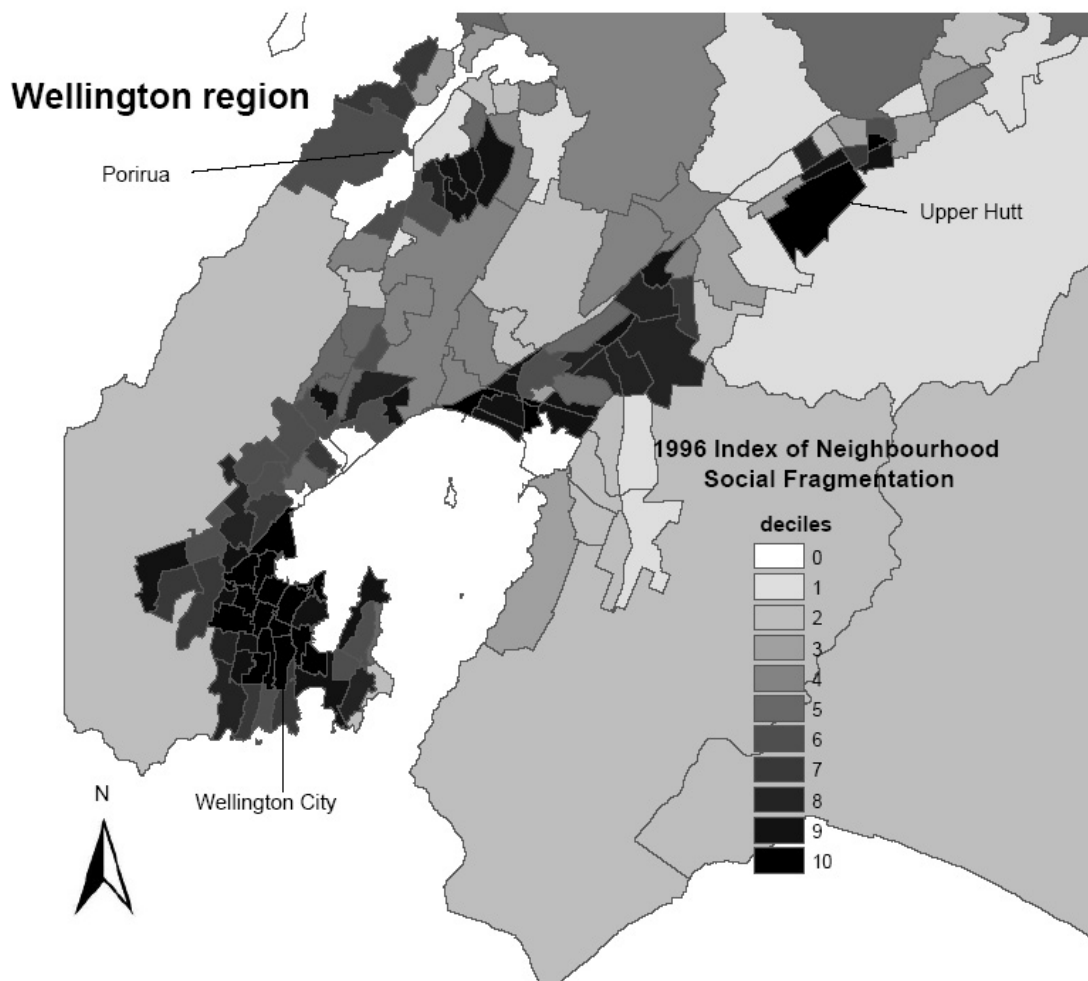


Figure 3:6: 1996 Distribution of NeighFrag in Urban Areas (Wellington)

0 = missing values, 1 = least fragmented, 10 = most fragmented

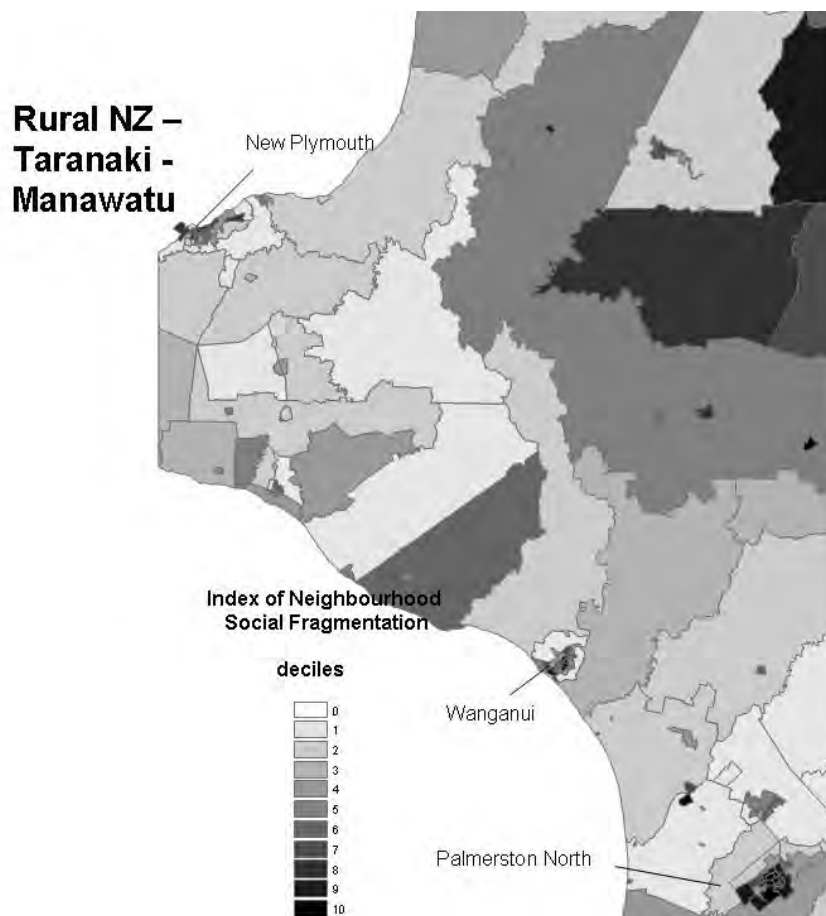


Figure 3:7: 1996 distribution of NeighFrag in rural areas (Taranaki - Manawatu)

0 = missing values, 1 = least fragmented, 10 = most fragmented

In this instance, the rank correlation with the NeighFrag index (-0.59) was the stronger (Table 3:3). The moderate, rather than very strong relationship provided further validation of the measure and the hypothesis that the index is capturing an antecedent to neighbourhood social processes. While fragmentation predicted neighbourhood levels of volunteering, the index did not appear to be simply an inverse measure of social capital. Instead it suggests that the index may provide a context for volunteering, but that other factors may also be important.

Table 3:3 Spearman Correlation Coefficients for NeighFrag and Other Area Indexes

| Index | 1996 | | | | 2001 | | | |
|----------------|------|------|------|-------|------|------|------|-----|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4* |
| 1 NeighFrag | 1.00 | 0.86 | 0.41 | -0.59 | 1.00 | 0.86 | 0.49 | n/a |
| 2 Congdon (NZ) | | 1.00 | 0.55 | -0.36 | | 1.00 | 0.67 | n/a |
| 3 NZDep | | | 1.00 | -0.12 | | | 1.00 | n/a |
| 4 SoCInd | | | | 1.00 | | | | n/a |

p-values for all coefficients were <0.001

* n/a - not available

Both the NeighFrag and Congdon(NZ) indexes of fragmentation were moderately correlated with the NZDep deprivation index (range 0.41-0.67), although the rank correlations for the Congdon index were stronger (0.55 and 0.67) (Table 3:3) (While NZDep is created at the smaller meshblock level, area unit values were provided for comparison with NeighFrag. Area unit values are created from the average meshblock value, weighted by population (Salmond et al., 2007)). The ecological relationship between the fragmentation indices was further explored by investigating the distribution of area units. The distribution revealed a closer relationship than was suggested by the moderate correlation at either extreme of deprivation and fragmentation, with, for example, very few non-fragmented neighbourhoods among the most deprived neighbourhoods (Figure 3:8). Both the correlations and distribution of the area units provide support for the validity of the NeighFrag Index. The moderate, but positive relationship is in keeping with the NeighFrag index capturing a separate construct from socioeconomic deprivation or social disorganisation.

The ecological distribution of NeighFrag area units by NZDep area units (1996)

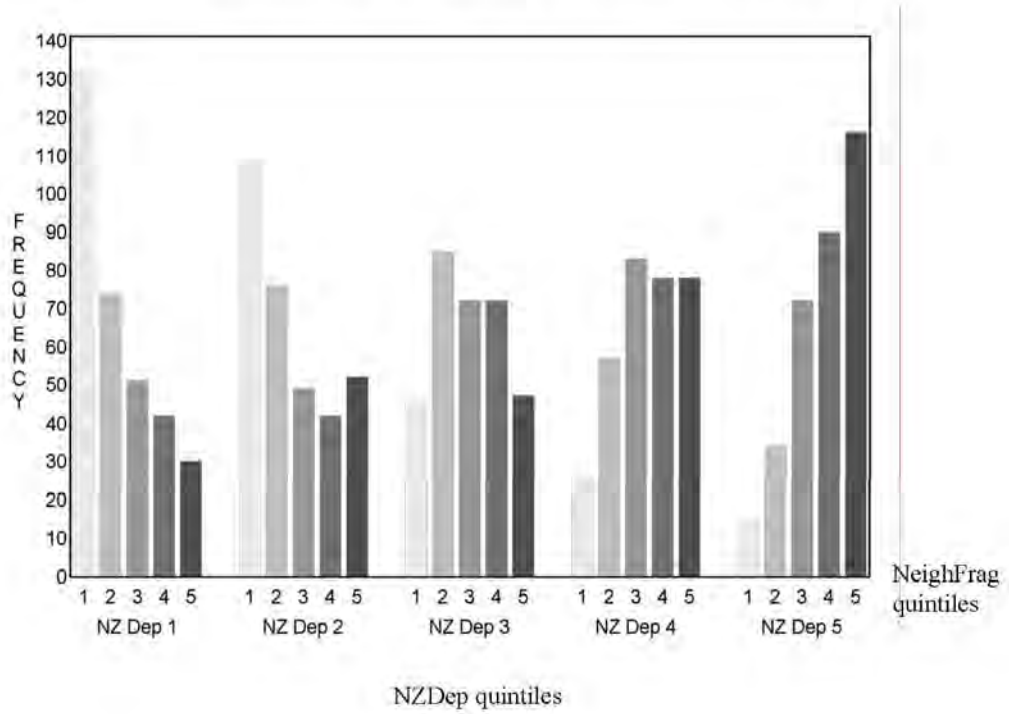


Figure 3:8a The Ecological Distribution of NeighFrag Area Units by NZDep Area Units (1996)

NeighFrag 1 = least fragmented, NeighFrag 5 = most fragmented

The ecological distribution of Congdon(NZ) area units by NZDep area units (1996)

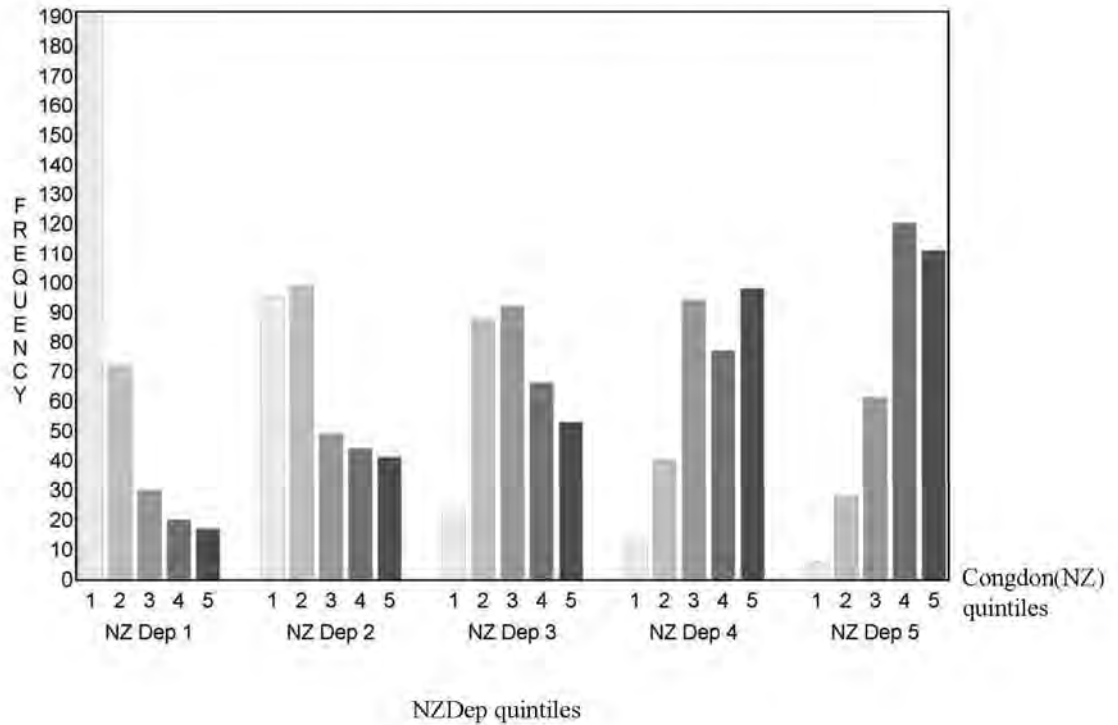


Figure 3:8b The Ecological Distribution of Congdon(NZ) Area Units by NZDep Area Units (1996)

Congdon(NZ) 1 = least fragmented, Congdon(NZ) 5 = most fragmented

Examining how the composition of neighbourhoods varied by fragmentation at the ecological level provided important information for understanding both the index and the construct. The index itself has summarized the ecological variation in the proportions of nine selected characteristics of the people living in neighbourhoods. It was therefore interesting to see whether other important non-index demographic and socioeconomic factors also varied by fragmentation at an ecological level.

The mean proportions of ethnicity, age, and labour force status characteristics in area units were examined for their relationship with NeighFrag, stratified by sex.

Neighbourhood proportions of selected characteristics, for example age group, were created:

$$\frac{\text{Age group in area unit}}{\text{Total population in area unit}}$$

The mean proportions were then regressed on NeighFrag deciles to examine variation in neighbourhood composition and its association with fragmentation. Either a linear or quadratic relationship was allowed to crudely see what best explained variation, as evidenced by the adjusted R² and p-values for the *F* statistics for the NeighFrag predictor variable. The relationship which accounted for most of the variation is reported here with the appropriate R² values. All age and ethnicity groups were investigated, with a summary of the pertinent relationships discussed below. The labour force status analysis was restricted to the 15-64 year old population for whom the labour force status questions were relevant (otherwise there was a risk of confusing the proportion of children (that is, age) in a neighbourhood with the proportion of 'not in labour force' which was assessed separately. There was little difference noted in the gender composition of neighbourhoods by NeighFrag, except in the older age groups (discussed further below). These analyses were conducted jointly with Clare Salmond (biostatistician).

The mean proportion of both 15-34 and 75+yr olds in a neighbourhood increased as fragmentation increased (Figure 3: 9 a-d). The regressions suggest that highly fragmented neighbourhoods have significantly higher proportions of both these age groups and hence fewer middle age people. However, the mean proportion of 75+ yr old *men* decreased at the highest levels of fragmentation (possibly for reasons such as different survival rates) (Figure 3: 9b). While it might be expected that the distribution of the elderly might be similar to that of children and family households rather than the more mobile 15-34 yr olds, as an age group they may share many of

the characteristics of the younger group, with higher numbers living alone, possibly not in their own homes, and may be more likely to change residence as they move into more sheltered accommodation (for example). It should also be noted that while there was some difference between the distribution of mean proportions of men and women by age group the actual difference in proportions was small.

The ethnic composition of neighbourhoods also varied by fragmentation Figure 3: 10 a-d. Using standard categories relevant to the New Zealand population the mean proportions of non-Māori, non-Pacific generally decreased as fragmentation increased, until NF10 where there was an increase in the mean proportion (Figure 3: 10 a,b). As might be expected, the proportion of Pacific people increased with higher fragmentation (not shown). What was more interesting was the relationship between Māori composition and NeighFrag. Mean proportions of Māori demonstrated a general increase as fragmentation increased but then decreased at the highest levels of fragmentation (Figure 3: 10 c,d.)

There was no evidence of an ecological relationship between NeighFrag and the labour force status of 15-64 year olds (Figures 3:11a-f). For example, the proportion of unemployed 15-64 year olds in a neighbourhood was not statistically significantly predicted by NeighFrag (all p values for the F statistics were considerably larger than 0.05). The low values for the adjusted R² indicated that very little variation was captured by the model fit with either a linear or quadratic term.

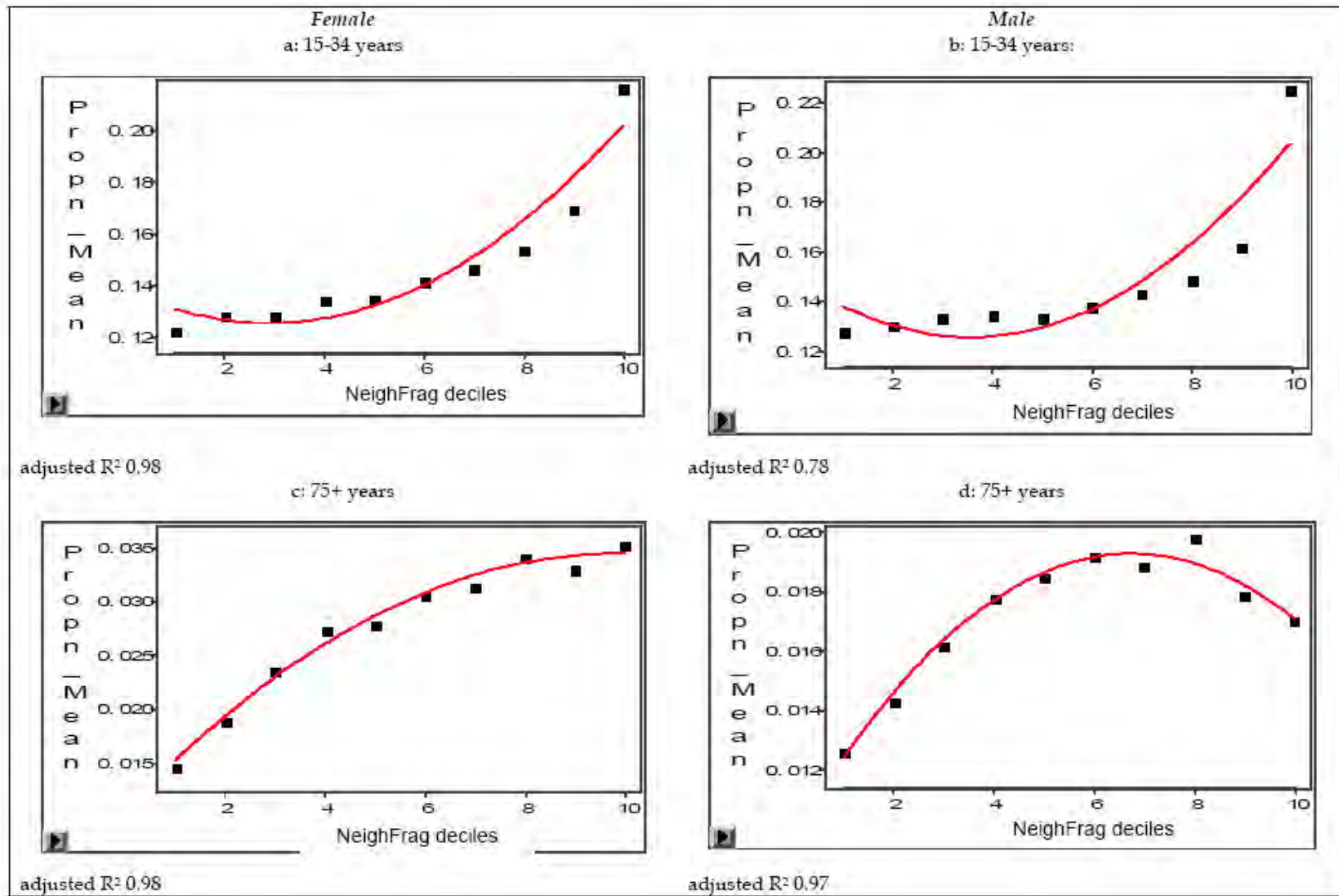


Figure 3: 9 a-d The ecological relationship between age group and NeighFrag

Adjusted R² accounting for the proportion of variation explained by the model. Using F tests all the predictors were significant at the conventional levels ($P > 0.05$).

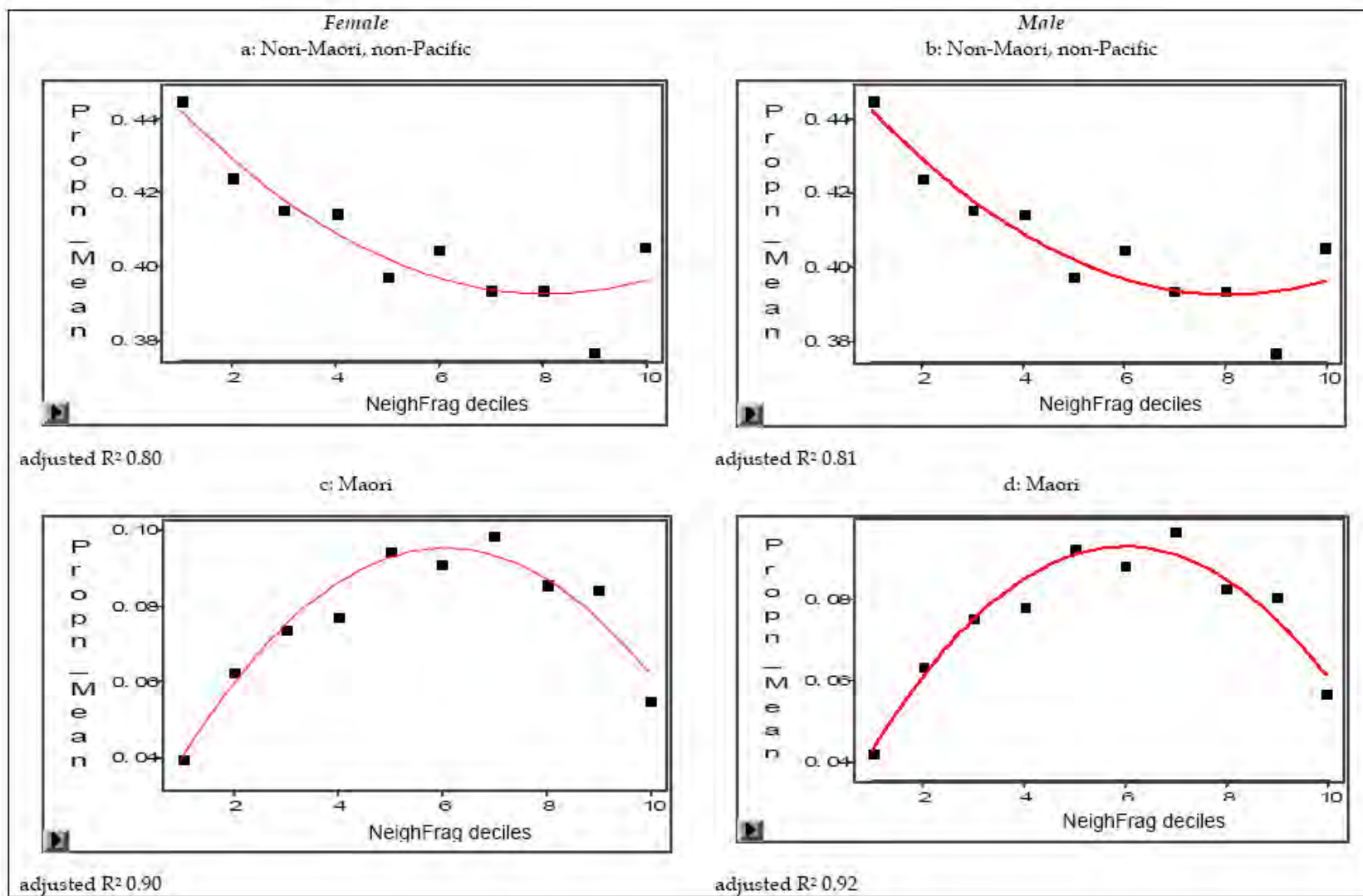


Figure 3: 10 a-d The ecological relationship between ethnicity group and NeighFrag

Adjusted R² accounting for the proportion of variation explained by the model. Using F tests all the predictors were significant at the conventional levels ($P > 0.05$).

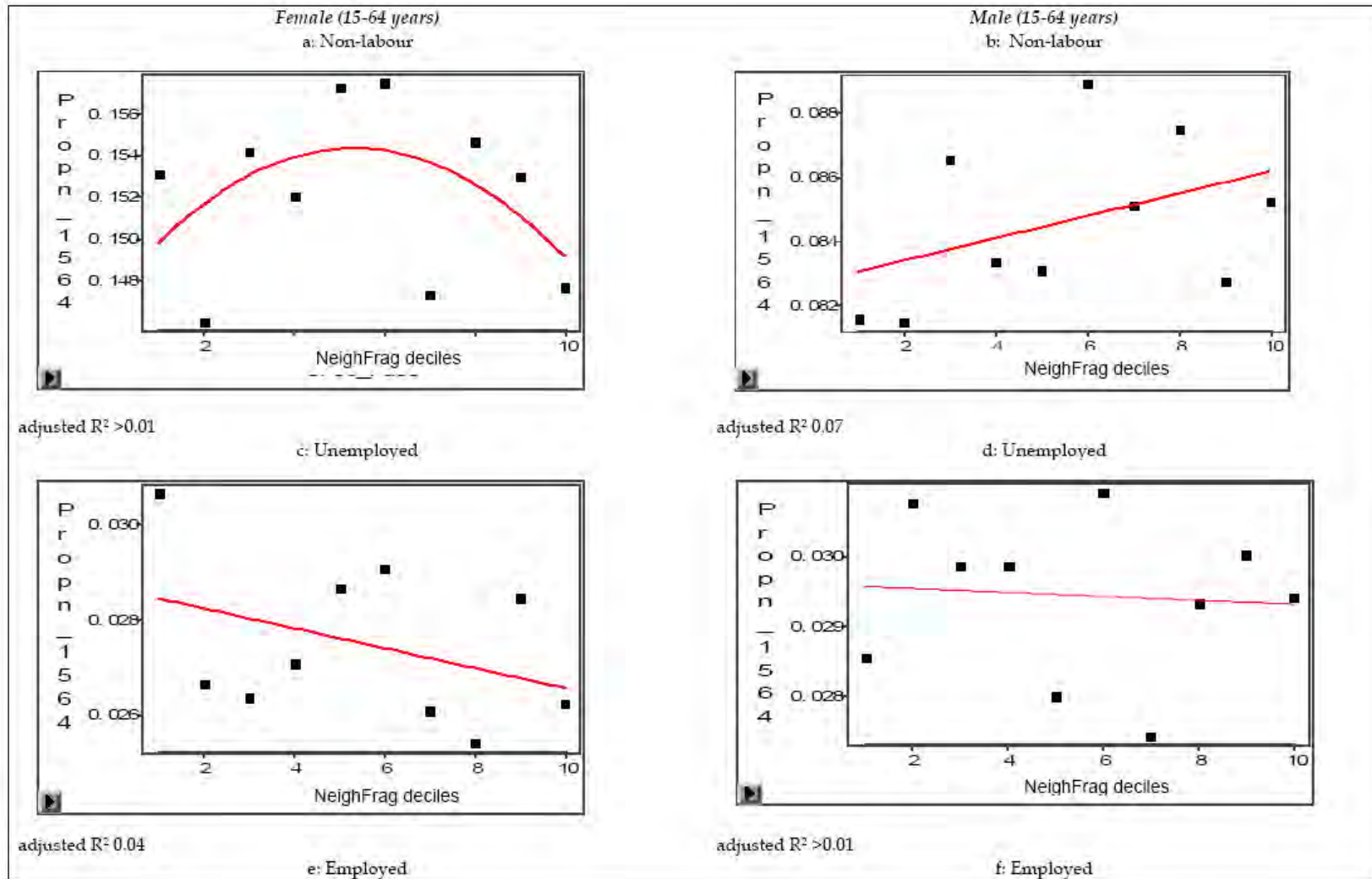


Figure 3: 11 a-f. The ecological relationship between labour force status for 15-64 year olds and NeighFrag

Adjusted R² accounting for the proportion of variation explained by the model. Using F tests, all the predictors were non-significant at the conventional levels ($P > 0.05$).

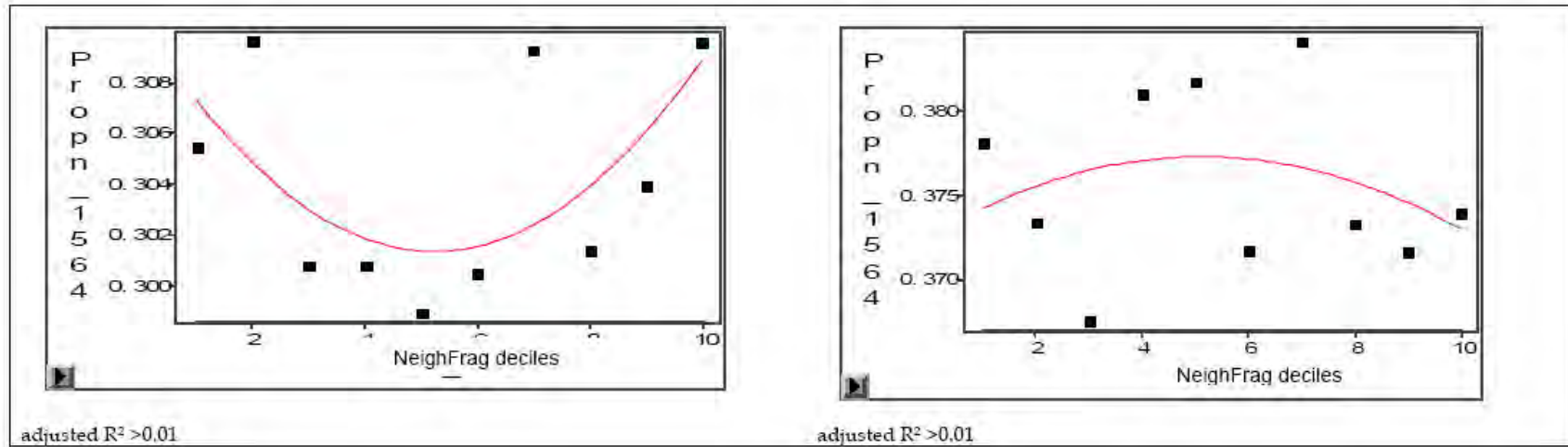


Figure 3: 11 a-f. (continued) The ecological relationship between labour force status for 15-64 year olds and NeighFrag

Adjusted R² accounting for the proportion of variation explained by the model. Using F tests, all the predictors were non-significant at the conventional levels ($P > 0.05$).

3.5.2 Who Lives Where? Distribution of Individual Level Factors by NeighFrag

As well as examining ecological relationships, it was useful to explore who lived where in relation to neighbourhood fragmentation. This time the unit of analysis is the individual rather than the neighbourhood. The distribution of the population was investigated by contextual factors and individual characteristics. Information on who lived where provided useful data for the design of analyses later on, for example, potential confounders. Variations in the percentage of, for example, men, living in each NeighFrag decile were examined. The characteristics were firstly examined by sex and then combined. Because there was little difference between the sexes the non-stratified results are presented here.

Firstly, the distribution of the population by fragmentation was examined for ecological, demographic, and socioeconomic factors. The distribution of sex, ethnicity, and age characteristics was, not unexpectedly, very similar to the ecological relationship presented above and so shall not be repeated here. While the decile groups had roughly similar numbers of area units, the census population was unevenly distributed across NeighFrag deciles. The results suggested that smaller population sized area units tended to be the least fragmented. The percentage of the population increases in each decile group as fragmentation increases until NF9 where there is a slight decrease (Figure 3:12).

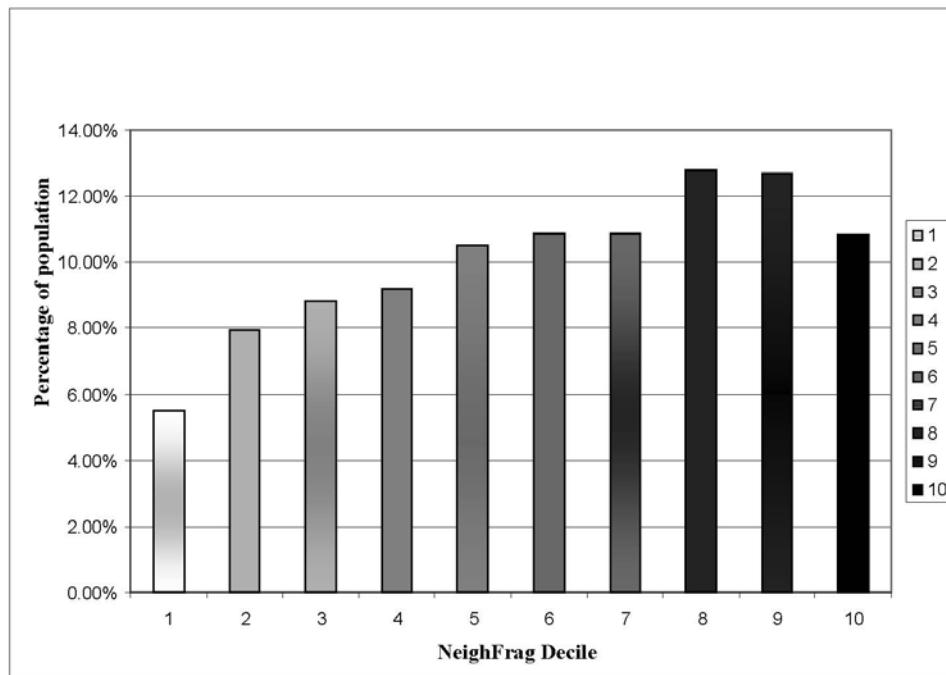
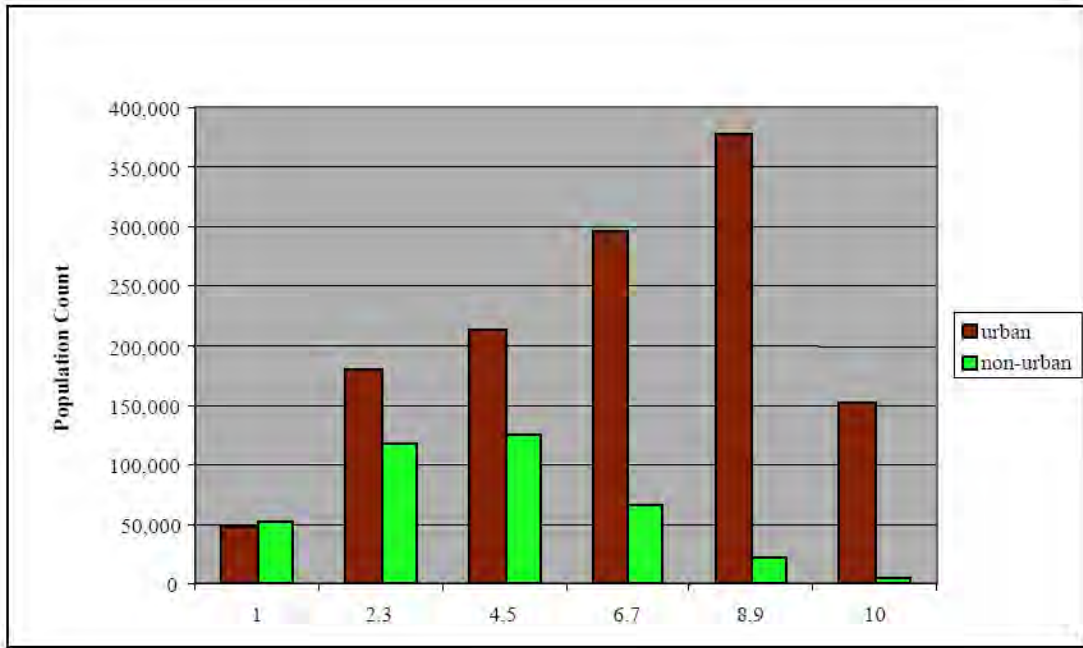


Figure 3:12 The Distribution of the Population by NeighFrag

The NeighFrag distribution of the population was further examined by urbanicity and area deprivation, two important contextual factors that had implications for the analyses design (Figures 3:13-14). The distribution of the population across urban/rural and deprivation quintiles shows a similar relationship to the ecological distribution reported above but highlights that the population itself is not as evenly distributed as the area units. In particular, the percentage of the population living in rural NF10 is very small, whereas in NF 1, the urban/rural split was almost even (Figure 3:13). The small numbers living in NZDep deciles 7-10 in the least fragmented neighbourhoods suggested that caution would be needed in the interpretation of regression results, and in making inferences about people in deprived areas in the least fragmented neighbourhoods (Figure 3:14).



NeighFrag decile (grouped)

Figure 3:13 The NeighFrag Population Distribution Across Urban/Rural Settings

The distribution of individual indicators of socioeconomic status by NeighFrag was also investigated. The percentage of each characteristic has been calculated from the people residing in each NeighFrag decile. For example, of all the people living in NF1, the percentage of each ethnicity group has been calculated (Table 3:5). The results are discussed by each characteristic below.

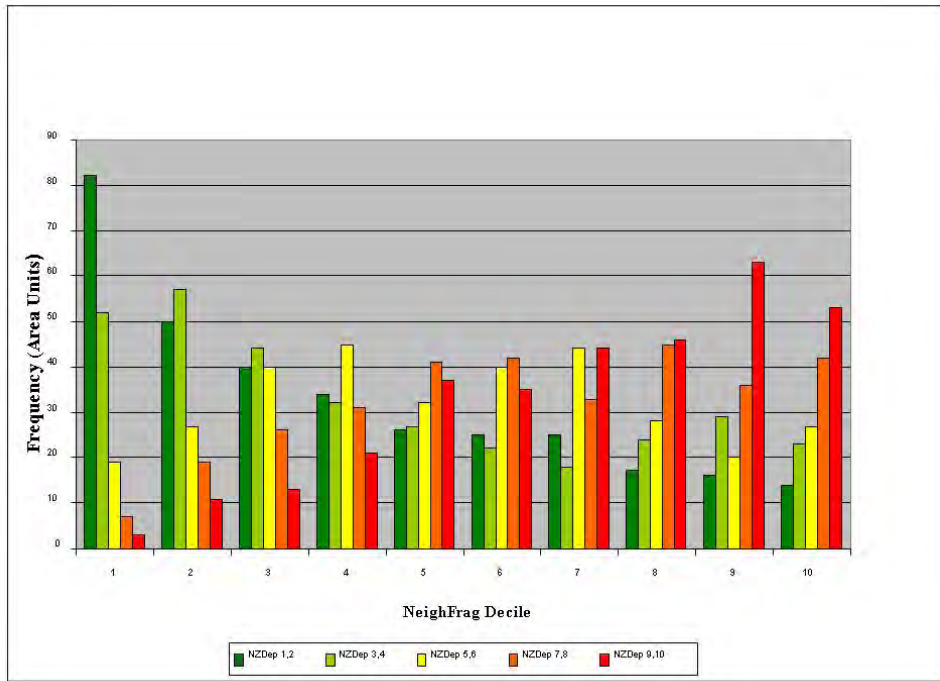


Figure 3:14a - Comparing the NZDep distribution of area units (a) and individuals (b) by NeighFrag

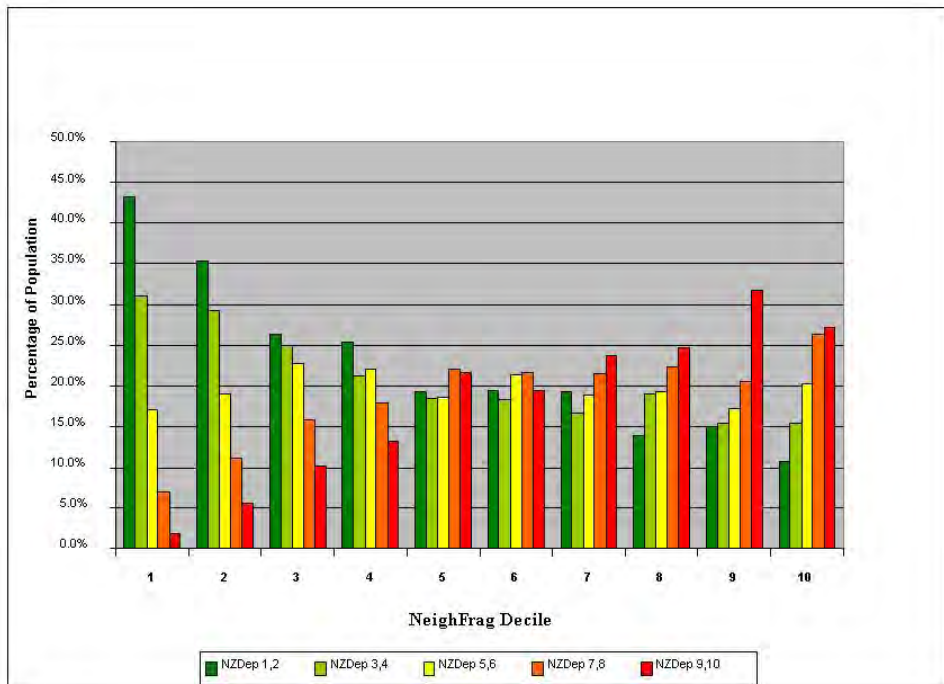


Figure 3:14b

Table 3:4 The percentage distribution of individual socioeconomic factors within NeighFrag deciles

| <i>NeighFrag</i> | Percentage in each category by NeighFrag deciles | | | | | | | | | | |
|------------------|---|-------------------|----------------|-------------------------|------------------|-------------------------|---------------------------------|--|----------------------------|--------------------------------|-------------------------------------|
| | <i>Car Access (household)</i> | | | | <i>Ethnicity</i> | | | <i>Highest education qualification</i> | | | |
| <i>Decile</i> | <i>% Missing</i> | <i>% Nil Cars</i> | <i>% 1 Car</i> | <i>% 2 or more Cars</i> | <i>% Maori</i> | <i>% Pacific People</i> | <i>% Non-Maori, Non-Pacific</i> | <i>% Missing, NA, Still at School</i> | <i>% No Qualifications</i> | <i>% School Qualifications</i> | <i>% Post-School Qualifications</i> |
| 1 | 5.58 | 2.55 | 26.27 | 65.6 | 7.57 | 0.77 | 91.66 | 27.04 | 24.94 | 23.81 | 24.20 |
| 2 | 6.3 | 3.94 | 29.87 | 59.89 | 10.89 | 1.29 | 87.82 | 27.15 | 24.30 | 23.42 | 25.13 |
| 3 | 6.88 | 4.92 | 32.79 | 55.4 | 13.62 | 1.20 | 85.18 | 27.46 | 26.23 | 22.90 | 23.41 |
| 4 | 7.21 | 5.93 | 34.72 | 52.15 | 14.22 | 1.70 | 84.09 | 27.12 | 26.18 | 22.80 | 23.90 |
| 5 | 7.62 | 7.56 | 36.79 | 48.04 | 17.43 | 2.41 | 80.16 | 27.73 | 27.43 | 22.19 | 22.66 |
| 6 | 7.28 | 7.97 | 37.15 | 47.59 | 16.80 | 2.47 | 80.72 | 27.04 | 26.02 | 22.86 | 24.08 |
| 7 | 8.01 | 8.49 | 36.65 | 46.85 | 18.61 | 4.15 | 77.24 | 27.69 | 25.25 | 22.64 | 24.42 |
| 8 | 8.2 | 9.42 | 36.72 | 45.66 | 15.16 | 7.86 | 76.98 | 27.57 | 25.13 | 23.32 | 23.98 |
| 9 | 9.23 | 11.42 | 36.68 | 42.67 | 15.07 | 11.93 | 73.00 | 28.14 | 23.84 | 23.23 | 24.80 |
| 10 | 14.08 | 13.56 | 35.03 | 37.33 | 10.58 | 8.23 | 81.20 | 23.04 | 18.73 | 27.70 | 30.53 |
| <i>All</i> | 8.28 | 8.14 | 34.93 | 48.65 | 14.46 | 4.79 | 80.75 | 27.01 | 24.74 | 23.49 | 24.76 |

Table 3:5 continued

| <i>NeighFrag</i> | Percentage in each category by NeighFrag deciles | | | | | | | | | |
|------------------|---|-------------------------|------------------------|------------------------|----------------------------|------------------|---------------------|---------------------|----------------------|--|
| | <i>decile</i> | <i>Household Income</i> | | | <i>Labour force status</i> | | | | <i>Dwelling type</i> | |
| | | <i>% Missing data</i> | <i>% Lowest Income</i> | <i>% Middle income</i> | <i>% Highest Income</i> | <i>% Missing</i> | <i>% Non-Labour</i> | <i>% Unemployed</i> | <i>% Employed</i> | <i>% usual residence, Private Dwelling</i> |
| 1 | 16.35 | 29.58 | 24.65 | 29.42 | 26.03 | 19.26 | 2.19 | 52.51 | 93.89 | 6.11 |
| 2 | 18.11 | 28.60 | 23.50 | 29.79 | 26.00 | 22.11 | 2.59 | 49.29 | 93.24 | 6.76 |
| 3 | 18.74 | 31.13 | 22.61 | 27.52 | 26.07 | 24.21 | 2.98 | 46.74 | 92.49 | 7.51 |
| 4 | 19.71 | 30.53 | 22.63 | 27.13 | 25.77 | 25.21 | 3.22 | 45.80 | 92.19 | 7.81 |
| 5 | 20.65 | 33.36 | 21.82 | 24.17 | 26.18 | 26.91 | 3.59 | 43.32 | 91.84 | 8.16 |
| 6 | 20.67 | 31.55 | 21.96 | 25.82 | 25.49 | 27.11 | 3.68 | 43.71 | 92.16 | 7.84 |
| 7 | 22.93 | 30.43 | 20.77 | 25.86 | 26.11 | 26.88 | 4.04 | 42.96 | 91.39 | 8.61 |
| 8 | 23.61 | 30.09 | 20.93 | 25.37 | 25.73 | 27.04 | 4.06 | 43.17 | 91.55 | 8.45 |
| 9 | 25.61 | 29.55 | 19.05 | 25.79 | 26.13 | 26.70 | 4.55 | 42.62 | 90.68 | 9.32 |
| 10 | 29.79 | 26.56 | 16.88 | 26.76 | 20.44 | 27.74 | 5.32 | 46.50 | 85.73 | 14.27 |
| All | 22.20 | 30.16 | 21.16 | 26.48 | 25.34 | 25.81 | 3.77 | 45.07 | 91.29 | 8.71 |

Car access

In NF1, approximately two thirds of households have access to 2 or more cars, compared to the national average of half of all households. There was a steady decline in the percentage as fragmentation increases, which was matched by a substantial increase in the percentage of households without car access. The percentage of households with 1 car generally increased as well, but to a lesser degree and peaked at NF5. In NF10, the percentage of households is almost evenly split between 1 car (35.5%) and 2 or more car (37.3%) households.

Ethnicity

As can be seen in Table 3:5 the distribution of individuals by NeighFrag was very similar to the pattern seen in the ecological analysis above (Figure 3: 10 a-d), and so will not be repeated here.

Education

There was mixed evidence of an association between NeighFrag and education qualifications. People living in NF10 were more likely to have a post-school qualification (30.5%) compared to those living in NF1 (24.2%). However, the percentages showed little variation in fragmentation levels below NF10. For example, for post school qualifications the percentage only ranged from 24.2% (NF1) to 24.8 (NF9).

Household Income

There was limited evidence for an association between household income and fragmentation. The percentage of people with middle income declines slightly as fragmentation increases (from 24.7% in NF1 to 16.9% in NF10), but there was little systematic change for lowest and highest incomes. However a strong association was observed for missing income information. Overall, 22% of the population do not have their income status defined and the percentage increased with fragmentation.

This is consistent with household income being inestimable where someone is absent on census night, a factor that might be expected to be more common in more fragmented neighbourhoods.

Labour Force Status

The distribution of labour force status of *all* individuals varied by fragmentation. The least fragmented areas tended to have relatively more employed people (for example, 52.1% in NF1). A small but steady decrease until NF9 in the percentage of employed with increasing fragmentation is accompanied by a steady increase in the unemployed. The percentage of non-active labour force status increased until NF5 where there was little change in higher deciles. This may reflect the composition of this group which will include tertiary students, at home parents and those unable to work, who may have different and contradictory distribution patterns. There is little evidence of a relationship between NeighFrag and people with missing labour force status and fragmentation.

Dwelling type

Over 90% of the total population are usually resident in private dwellings. However there was considerable variation across deciles in the distribution of those usually resident in non-private dwellings (6.1% in NF1 to 14.3% in NF10), as expected.

In summary, NF1 neighbourhoods have higher proportions of people who are employed, have 2 or more cars, and who are non Māori, non Pacific and who live in private dwellings. They are equally likely to live in rural or urban settings. NF10 neighbourhoods, on the other hand, are less easily defined. Residents are more likely to be highly educated. While those identifying as non Māori, non Pacific are still the majority, there are more likely to be Māori and Pacific people than in less fragmented neighbourhoods. Households are more likely to have one or nil cars, but most will still have 2 or more cars.

3.6 Discussion

Neighbourhoods vary in their composition and therefore, it is argued, in their ability to provide a foundation for a socially cohesive and supportive environment. This variation has been captured by a census-based Index of Neighbourhood Fragmentation (NeighFrag) which ranked moderately-sized areas according to characteristics of individuals hypothesised to have a fragmenting effect on the social structure of a neighbourhood. The process of developing the neighbourhood fragmentation index and subsequent examination has helped to shed more light on what social fragmentation might mean at the neighbourhood level, thereby contributing to the research field.

The NeighFrag index was a result of the logical operationalisation of a conceptual model (Frohlich et al., 2007). Based on the literature it was determined that the ability of neighbourhoods to act as a collective in some way was related to the structural antecedents present in the neighbourhood. The antecedent factors were summarised in three domains. Regarding the neighbourhood social environment in this way gave a clearer theoretical context for the role for of variables used in the Congdon index, and therefore the potential inclusion of other indicators, such as children.

The model provided a guide for further indicators to be sought from other data sources in future research. For example, the means for sharing norms and values across neighbourhoods may also be represented by physical spaces, social events, or local activism (to name but a few).

Thirdly, perhaps most importantly, the model provides a guide for the use of the index in research. This is not to imply a prescriptive use of the variables or the index. Rather, the model illustrates why and how the variables act as an indicator of the construct of neighbourhood fragmentation. Such clear upfront specification helps to avoid the difficulties associated with a theoretical vacuum referred to above. Using

Susser's 1994 classification of ecological variables (cited in the index uses an aggregation of individual characteristics to measure a neighbourhood variable. As discussed above the fragmentation of a neighbourhood is a property of the place, not an aggregation of the levels of integration of the individuals within it. Therefore it could be argued that the index is capturing a latent construct; that is a global or integral variable according Blakely and Woodward (2000). It is for this reason that "neighbourhood" was included in the name of the index, to help clarify the site of fragmentation, and thereby reducing the risk of fallacy in readers' minds.

The results of the initial exploration of the NeighFrag index suggested that a meaningful neighbourhood measure had been created. The index demonstrated the expected ecological relationships with measures of neighbourhood deprivation and social capital, supporting the case that it represents a construct related to, but different from the other neighbourhood characteristics. The index was also related to other compositional neighbourhood characteristics such as the ethnic and age make up of a neighbourhood. This suggested that social fragmentation of a neighbourhood might also be related to other social processes in New Zealand society that play a part in how people migrate between neighbourhoods.

The distribution of the population by NeighFrag index was examined to inform its use in future analyses. Of particular note was the relationship between urbanicity and NeighFrag. The ecological distribution of NeighFrag area units by urbanicity suggested that the index was not simply measuring a degree of urbanicity as there was a range of NeighFrag values across rural and suburban CAU's. However when the distribution of the population across the two factors was examined it suggested that fragmentation may mean something different in urban and rural settings. It may be that the index is capturing regional processes of mobility and settlement patterns. That is, a more urbanised centre may be relatively more fragmented than the surrounding area because of household tenure and education factors (for example).

Further, the uneven distribution of the people in each NeighFrag decile across urban and rural categories could also create challenges for analyses: for example, the small number of people living in the more highly fragmented rural neighbourhoods would place limitations on statistical analyses of their health if the analyses were stratified by urbanicity.

3.6.1 Limitations

Census-based indices take advantage of existing robust national data but may be biased through misclassification of individuals and neighbourhoods. While the index attempts to capture the 'neighbourhood' it is nevertheless reliant on administratively defined boundaries. If CAU boundaries do not reflect locally recognised neighbourhoods then areas may be misclassified. This may particularly be the case in rural areas which may be more likely to be an aggregation of smaller communities that may be more heterogenous than aggregations in urban CAU's. Flowerdew et al (2008) gave an example from Scotland where villages within a ward might have quite separate identities. Nevertheless, CAU's are recognised as the most meaningful and valid unit available in New Zealand and were therefore the most appropriate scale.

Inaccuracies of individual observations may bias the derived proportions within neighbourhoods, which are the building blocks of the index. Furthermore, the distribution of missing income data across NeighFrag indicates that living in less fragmented areas was somehow associated with a fuller completion and/or participation in the census activity. This would be likely to have led to less complete data being available for participants in more highly fragmented areas, with potentially less accurate measurement of these areas. Similarly, the very small, but non-zero non-participation rate in the national census is non-randomly distributed (Ewing, 1997). Non-participation was associated with age, gender, ethnicity, with younger men, Pacific People and those living in the northern part of the North Island more likely to be under reported. Because of the observed relationship between

NeighFrag and age and ethnicity, it is likely that undercounting was more likely in highly fragmented neighbourhoods. However, the level of undercounting was estimated to be very small (approximately 1.5% for 1996 (Ewing, 1997)) and therefore the extent to which it would contribute to meaningful misclassification of areas would be minimal.

Of greater importance to the validity of the index was the inability to capture other factors that might contribute to the construct but which were not available from individual administrative data (Frohlich et al., 2007). In particular, as the index was based on population counts it could not take into account other features of the neighbourhood that may contribute to its social structure, such as geographical topography, history, or other unmeasured common interests. Baum et al (2002) have argued that certain places within a neighbourhood can become 'opportunity structures' for social interaction within the neighbourhood. The potential contribution of factors such as these was very important but was not able to be captured here. Thus, the index score can not fully represent the actual levels of resources, attachment, or communication opportunities for sharing present in a neighbourhood. While the index has attempted to capture a latent construct, it needs to be remembered that it is not a 'direct' measure of the neighbourhood but an aggregate measure using individual-level data.

Ideally, the index has captured the compositional nature of neighbourhoods thought to contribute to neighbourhood fragmentation. However, other local factors will also be important antecedents to the collectivity of an area. Cohen et al (2008), Halpern (1995) and Baum and Palmer (2002), for example, emphasised the contribution of the built environment to community life. As suggested in the use of the 'social topography' metaphor, geographical features can play an important part in how residents relate to one another and the neighbourhood as a whole. The history of an area can play an important part in how a neighbourhood came to its current state.

None of these aspects were able to be directly measured in NeighFrag. However, they may well be represented in the composition to some degree. The geography and history may well be determining factors in the current composition of a neighbourhood. As proposed earlier by Frohlich (Frohlich et al., 2002) a recursive relationship is likely to exist between the geographical nature of a neighbourhood, its effect on how residents interact with each other and the environment, and then how they, as a collective and as individuals, go on to affect the geography in some way. The decision and resources to build a tunnel linking communities will be dependent on the nature of those communities, and the use of the tunnel will subsequently go on to influence the nature of those communities, and so on.

NeighFrag captures the compositional aspect of socially fragmented neighbourhoods. It would be hazardous to inflate it to be a complete measure of such a neighbourhood's fragmenting characteristics, and even more unfortunate to assume that it is a measure of the social cohesion or capital in the neighbourhood. Its use in analyses should reflect these inherent limits. A closer examination of the hypothetical relationship between the index and social cohesion and related constructs is discussed in Chapter Four

3.7 Conclusion

The use of administrative data to "...shed light on the interior of the "black box of places" ..." (Macdonald et al., 2007, p. 131) provides many opportunities as well as challenges. This chapter has presented an attempt to link available sources of information and meaning through the construction of a conceptual model.

The work presented above has been a response to the critiques raised in the review of the social fragmentation and general neighbourhoods and health literature. The index is not "off the shelf" (Macintyre et al., 2002), but is instead based on considered examination of the social fragmentation, cohesion and collective efficacy literature,

through which process a conceptual model of neighbourhood collective social functioning was developed. Three domains were deemed to be antecedent to the ability of a neighbourhood to act as a collective: the means of sharing of norms and values across a neighbourhood, attachment to people and place, and social resources. Fragmentation, then, has been understood as a paucity in these domains: less means of sharing norms and values, less attachment, fewer social resources.

Individual census data was used to operationalize the domains as fully as possible. Census area unit proportions of thirteen variables were created and their statistical relationships examined using Factor Analysis and Principle Components Analysis. Consequently, nine variables were selected to create a single factor, weighted index. It is argued that the Index of Neighbourhood Social Fragmentation has captured the compositional antecedents to neighbourhood collectivity (within the recognized constraints of the data available).

NeighFrag Indices were created from the 1996 and 2001 censuses. A New Zealand version of the Congdon Index was also created for comparative purposes. Increased understanding of the index has been sought by examining its relationship with other contextual and individual factors, which were also a means of establishing its validity and reliability. The expected relationships with area deprivation and a social capital indicator, SoCInd were observed. NeighFrag had a moderate, positive correlation with NZDep, but a moderate negative correlation with SoCInd, indicating that the Index was related to, but not simply a proxy for, either deprivation or indicators of social capital such as volunteering.

The question remained however, as to how and why the index would be related to health outcomes at the individual level. The next chapter takes the index further by seeking to understand why the composition of neighbourhoods captured by the index might be an important factor for individual health.

Chapter 4

From Data to Theory - Developing a Theory of Neighbourhood Fragmentation.

Having created the NeighFrag index the question is now, how do we use it? The purpose of this chapter is to establish why, as well as how neighbourhood fragmentation, as measured in the NeighFrag index, might be related to health. As noted in Chapter One, project timelines dictated that the index was created before a substantial review of the theoretical literature. By placing the index within a broader theoretical framework, I will be able to explicitly establish firstly the theoretical nature of the relationship between the index and health outcomes, and therefore secondly the mechanisms operating between the neighbourhood and individual health outcomes that could be empirically investigated. The theory will then provide a lens for viewing and understanding the data throughout the thesis (Carpiano and Daley, 2006b, Carpiano and Daley, 2006a).

A key driver for the chapter was the opportunity to do analyses using census data on individual smoking. From an epidemiological perspective this was a valuable opportunity to use a national dataset with comprehensive data on both individual and neighbourhood level variables. The problem posed by the opportunity was that there was no clear precedent in the neighbourhood-level social fragmentation literature of a theoretical or empirical relationship between measures of neighbourhood fragmentation and individual smoking. Therefore the question remained about how any associations could be interpreted. The focus in the text below is on establishing the theoretical mechanisms by which neighbourhood fragmentation might be related to health. Once the theoretical mechanisms were established empirical analyses could be designed, tested, and meaningfully interpreted.

The attention first turns to Emile Durkheim's original work on the relationship between the individual and society. The intention is not to fully critique Durkheim (which would be beyond the scope of this thesis) but to return to his original works and consider how they might be informative for understanding how NeighFrag might be related to health. While other theorists such as Bourdieu have been more recently discussed in the neighbourhoods' literature, returning to Durkheim's original work offered a valuable opportunity to gain new insights into the constructs being examined. The role of the geographic neighbourhood in his work is discussed, with the conclusion that neighbourhoods could potentially be acting as an intermediary 'social group', or society, between the individual and the wider world. Durkheim regarded the 'social group' as a site where the tensions between the wills of the individual and the collective were balanced, with consequences for the integration and regulation of both groups and individuals. Either an excess or paucity of integration and regulation was considered by him to be harmful for individual well being (Durkheim, 1951).

The second section of the chapter then turns back to NeighFrag, bringing the theory (from Durkheim's work), and the data (the empirical NeighFrag index) together. Based on the proposed interpretation of Durkheim's work, an argument is made that NeighFrag may be capturing different types of neighbourhood level social groups, with different levels of social integration and regulation. Two health-related mechanisms are proposed, capturing the processes between NeighFrag and health. Firstly, NeighFrag may be related to health because exposure to varying levels of social integration and regulation in a neighbourhood based social group may have health consequences. Secondly, NeighFrag could be related to how well social practices are transmitted within a neighbourhood based social group: in a highly integrated and regulated setting the transmission of health-related social practices may be higher than in a less integrated and regulated environment. Support from the

literature for each of the proposed mechanisms is discussed with a focus on how health outcomes might be sensitive to NeighFrag.

As discussed in the conclusion to the previous chapter, examining the associations of NeighFrag and health in New Zealand would in itself provide an informative comparison to the international findings. Adding the multilevel analyses undertaken here, and the information from the Congdon(NZ) version, would have built a substantial epidemiological body of evidence to determine if NeighFrag were related to health. But the opportunity to better understand how neighbourhoods might affect health would have been more limited. This chapter will therefore address an important critique raised in the international review by attempting to build an explicit theory of how neighbourhood fragmentation might be related to health: this theory could then be translated into empirical research. The model will drive the design of the analyses and the interpretation of the results in the chapters to follow.

4.1 Exploring Durkheim; What does Durkheim's Theory Tell us About the Social Environment of Neighbourhoods?

It would be difficult to underestimate the part played by Durkheim in neighbourhoods research. He has been referred to as the founder of both sociology as a science (Emirbayer, 2002) and social epidemiology (Syme, 2000). His work has also provided an important foundation for much of the neighbourhoods and health literature, starting with his thesis "Suicide" (Yen and Syme, 1999). While his work continues to be scrutinized and critiqued, his theoretical and empirical works continue to inform the research agenda, albeit in diverse and often contradictory ways (Rawls, 1996, Taylor and Ashworth, 1987).

Apart from his founding status and enduring influence, his work was of particular interest to this thesis. The recent interest in neighbourhood social fragmentation and suicide calls on his proposition that people are influenced by their local social

environment and refers directly back to his original work (Gunnell et al., 2003, Whitley et al., 1999). In the wider neighbourhood social properties literature, the extensive use of constructs such as social cohesion, integration and capital is a reflection of the ongoing importance of his theories (Berkman et al., 2000), although of course not without critique (Kushner and Sterk, 2005, Turner, 2003, van Poppel and Day, 1996).

As will be discussed further below, Durkheim spoke of the changing role played by geographic neighbourhoods in the lives of individuals and societies (Durkheim, 1964). Durkheim was concerned with how different types of social settings provide a context for balancing the needs of a society and its individual members. Types of settings can vary across time and spaces. For example, Durkheim was interested in the “moral restructuring” that takes place in society during times of economic upheaval. He argued that in times of economic change individuals can flounder because the new moral code has yet to be established.

He was also interested in how social contexts mattered for individuals. The perceived tensions between the needs of individuals and those of collectives, and how they might be managed, informs much of his work (Emirbayer, 2002), paralleling the social epidemiological focus on the dynamics between individuals and society (Syme, 2000). His interest in how groups such as families, occupational groups and religious societies potentially played an important role in the lives of individuals was of direct relevance here. While Durkheim’s focus was on the social context, he did not lose sight of the individual (Taylor and Ashworth, 1987). He was interested in the mechanisms between the individual and societies, particularly the downward processes by which the individual is influenced by the group (Thorlindsson and Bernburg, 2004).

And finally, Durkheim saw the theoretical and empirical worlds as two sides of the same coin – each was only of interest because of how it informed the other (Syme, 2000). An important feature of Durkheim’s body of work was the progression from theory to empirical analyses. He was not only interested in developing a grand theory of the relationship between society and the individual but also developing a methodology to test the mechanisms proposed – “that all his lofty beliefs would need to be conceptualized, specified, and empirically pinned down” (Emirbayer, 2002, p. xi).

4.1.1 Does Geography Matter?

While neighbourhood research has a strong foundation in Durkheim’s theories, the role of the geographic neighbourhood in his own work is less clear. Durkheim did not regard geographically bounded communities as a fixed concept, but rather saw the importance of geography as something that changed as society changed (Durkheim, 1964). In a more traditionally structured society, geographical differences could largely be explained by clan boundaries based on family ties. In societies based on “mechanical” solidarity, the social cohesion of the group stemmed from the similarities between individuals: “...there is little scope for differentiation between individuals; each individual is a microcosm of the whole” (Giddens, 1971, p. 76). Therefore there would be a high degree of homogeneity in the “peculiar customs and manners” (Durkheim, 1964, p. 186) within each ‘neighbourhood’ and differentiation between areas. Variation amongst locations existed but could be attributed to extended family, or clan relationships rather than geographical proximity.

As society changed away from a strongly mechanistic structure the influence of blood ties (through clans) decreased (Durkheim, 1964). Individuals would be more able to move between areas rather than staying with family groups. Geographical proximity, on the other hand, became more important in explaining differences between groups. Proximity meant that residents were more likely to be exposed to

their neighbours than people living further away, resulting in the clustering of customs and values. While neighbourhoods were nested inside larger scale organizations such as cities and regions, the 'neighbourhood' could still be considered a real social force in residents lives (Durkheim, 1964).

But as a society became increasingly 'organic' (Durkheim, 1964) and complex, so neighbourhood boundaries would become increasingly arbitrary and local cultures more diffuse, according to Durkheim. In a society based on organic solidarity, neighbourhoods and individuals could not be regarded as independent of each other, but are instead one functioning part of a wider system. Individuals and groups would be more reliant on others because of the increased specialization of roles, compared to the similarity between individuals in a society based more on mechanical solidarity. The social cohesion of a group would now be because of the interdependence between dissimilar parts (Giddens, 1971).

With relatively open boundaries between neighbourhoods there would be little differentiation in the "morality and customs" between geographic areas (Durkheim, 1964). Individuals were more likely to be aligned to non-neighbourhood groups, for example those based on their occupational setting. Neighbourhoods in a highly organic societal structure would therefore be relatively heterogeneous, with variations in the customs and beliefs largely due to residents membership of other social groups, such as their occupation, rather than the influence of their neighbours (Durkheim, 1964).

If we were to leave it at this point the conclusion would be that in today's organic and complex society (in Durkheim's terms) the geographic neighbourhood has little relevance. We would expect to see little variation or clustering in socially determined health behaviours and beliefs across neighbourhoods, and what there was could be attributed to residents' membership of other social settings. However, there is

another way of considering why neighbourhoods might be important for individuals. Durkheim did not regard the lack of differentiation resulting from a society based organic solidarity as a necessarily good thing. Durkheim used the outcome of the French revolution to argue that the (for example) more organic nature of society left individuals without any intermediary structures between themselves and the increasingly powerful State (Durkheim, 1964). A potential remedy to this pathology suggested by Durkheim was that other institutions could provide more proximal, secondary groups between the individual and the State (Durkheim, 1964). While he explored the example of occupational or professional groups most fully it is worth considering other potential intermediary groups available in today's society.

Berger and Neuhaus (Berger and Neuhaus, 2002) proposed that in modern day American society, the neighbourhood could also act as a Durkheimian intermediary or in their terms a "mediating structure" (Berger and Neuhaus, 2002, p. 233). While Durkheim did not specifically refer to neighbourhoods as being intermediary groups there are certainly grounds in his work for considering it as a possibility. For example, he did suggest that societies develop when individuals have common interests (Durkheim, 1964); geographical proximity could be one means of developing a common interest amongst a group of residents. He also proposed that regular contact with members of an interest group would foster attachment to that group (Durkheim, 1964), once again raising the possibility for geography to be important.

The potential of the neighbourhood to act as an important social context between the individual and the wider world has been discussed in the recent neighbourhoods' literature. A number of authors have proposed that geographical factors such as proximity, common places, and shared space make the geographic neighbourhood a relevant social space (Cohen et al., 2008, Roosa et al., 2003, Baum and Palmer, 2002, Veenstra, 2005, Wilcox, 2003). Some authors have explicitly described the way in

which geographically based communities act as a collective social group. For example, Fullilove et al (1998) referred to geographically based communities as social groups. They were described as being "...held together by the mutual actions and shared responsibilities of their members" (Fullilove et al., 1998, p. 926). Similarly, Frohlich et al (2001) specifically referred to the geographic neighbourhood as a social collective. In keeping with Durkheim's thesis, the neighbourhood social setting was not just a place where people do things, but also a place where those actions had a social meaning.

4.1.2 Where Does the Index Fit in? The Neighbourhood as an Intermediary Layer Between the Individual and Wider World

A consistent theme observed in Chapter Two's discussion of the international literature was the need to conceptualize the neighbourhood as one of a number of influences in residents' lives. In order to better understand the relationship between types of neighbourhoods and individual health it is first necessary to consider how the neighbourhood as a social context might fit into the wider scheme of things.

One useful way is to visualize the neighbourhood as nested between other contexts. Originating from Bronfenbrenner (Jack, 2005) the social ecological model has a long history in the neighbourhoods research field (Pols, 2003) and in public health (Dahlgren and Whitehead, 1991). In the ecological model, the neighbourhood has been framed as an environmental layer between more proximal spaces such as the household and the more distal sources of influence such as the work environment and economic conditions. Dahlgren and Whitehead proposed that comprehensive health interventions needed to be developed to encompass all levels of influence in order to be effective (Dahlgren and Whitehead, 1991).

But rather than just seeing the neighbourhood as one source of influence on an individual, the interaction between the layers has become increasingly recognized as

an important component in understanding neighbourhood – health relationships (Cummins, 2007b, Galster, 2003, Lake and Townshend, 2006). The characteristics of each layer then become important in understanding the effects of other layers. With a more complex reading of the ecological ‘layers’ model, the neighbourhood social environment can be seen as a layer through which the effect of the wider environment on the individual is mediated, and which also mediates an individual’s response to the wider environment.

I have simplistically illustrated the ecological model and the interaction between the levels in Figure 4:1. At the centre is the individual’s response to their total environment, with the mixed tones reflecting multiple levels of influence. In progressively larger layers are the levels of influence in an individual’s life, of which the neighbourhood is one (including social factors such as Durkheim’s “moral forces” but also other sources such as the built environment, geography, material factors and so on). Note that for clarity many other layers such as peer groups, workplaces and so on have not been represented here, but are assumed. The arrows going through each layer represent the way in which the influence of one layer needs to pass through other layers before it can have an effect on an individual’s response. It is the characteristics of each layer that determines how the arrow may pass through, in other words, how one layer mediates or moderates the effect of other levels of influence.

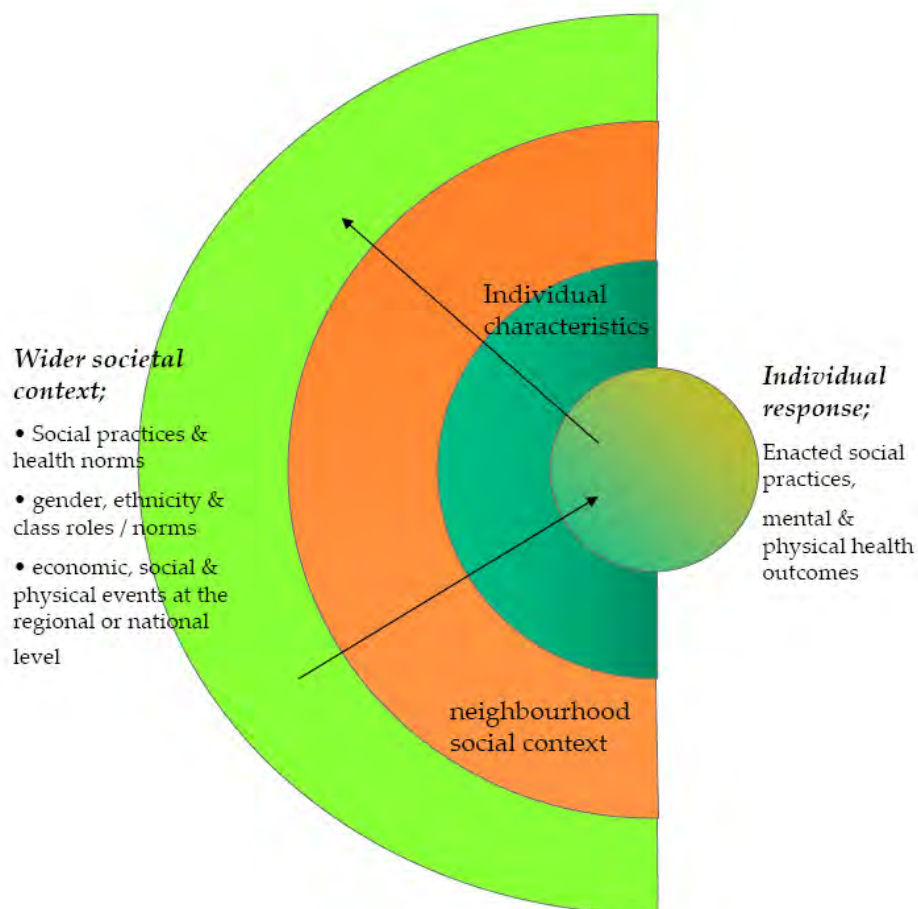


Figure 4:1 The Neighbourhood as a Nested Layer of Influence for the Individual
 At the same time it is important to consider how the individual is able to respond to the world around them. The nature of an individual's response will be shaped by many factors, including the characteristics of their various environments. Having a two way arrow captures both the recursive nature of social contexts discussed above, and also the way in which individuals responses (for example their health status or practices) will vary according to aspects of their environments.

Of course, neighbourhoods are not all the same. There has been some discussion in the literature on how different types, or characteristics, of social groups may be important for understanding the nature of the social environment within that group. For example, Gracia et al (1995) proposed that the density of the population, or whether communities were urban or rural, was associated with the levels of

integration and regulation of residents. With regard to the future, new technologies would mean that communities would be different again, and this could also potentially have a considerable impact on how communities were structured (Gracia et al., 1995).

Stephens (2008) queried the extent to which geographic neighbourhoods could act as communities (or social groups) in the New Zealand setting. While it was concluded that geographic neighbourhoods were often not pertinent to the social connections in people's lives, it was noted that for some people, and some types of neighbourhoods, geography mattered. Neighbourhood differences by urbanicity and deprivation were associated with differences in residents' local social connections: residents living in more highly deprived and also more rural neighbourhoods reported more local connections. It was also observed that inadequate community resources, or a local 'problem' increased residents local social connections (Stephens, 2008), perhaps by providing the "common interest" required for collectivity discussed in the previous chapter.

In an analysis of HIV/AIDS prevention and care in border communities in Brazil, researchers found that the type of community was a factor in the level of care. Certain local conditions such as high levels of mobility inhibited the ability of communities and agencies to act cohesively and collectively. The researchers argued that the constant mobility of the population was an example of a fragmenting characteristic of the region that inhibited the motivation to act as a collective to improve care (Lippman et al., 2007).

Balkundi et al (2007) focused on fragmentation of workplace social groups rather than neighbourhoods. Their work is of interest here because of their focus on the importance of different social group structures. They observed that having poor links between discrete sub groups within the workplace social group had consequences for

the performance of the whole team. Work teams that had moderate levels of connections between workers performed better than highly fragmented or highly cohesive teams. In keeping with Durkheim's notion of equilibrium, they found a curvilinear relationship between fragmentation of the workplace networks and performance. Higher levels of cohesion hindered workplace performance because there was less opportunity for new ideas and innovation that could improve performance. Conversely, highly fragmented workplaces also performed more poorly because a lack of communication across the team hindered the flow of knowledge, coordinating work, and so on (Balkundi et al., 2007).

The authors were specifically interested in examining why some workplaces were more fragmented than others (Balkundi et al., 2007). They found that the types of workplaces varied in their demographic makeup by factors such as age, gender and ethnicity of team members, as well as size and tenure of the team. While it was found that gender and age diversity was not important for fragmentation, having a diverse age structure was related to better connections across the work based social group. Bigger teams, particularly relatively young ones, were more likely to have many gaps or "holes" between individuals and groups, hindering communication within the workplace. In Durkheimian terms, then, the *type* of workplace setting was an important factor in understanding the nature of the social connections across the workplace.

Similarly, Cattell (2001) observed that the type of social network within a community was related to features of the local area. For example, the level and quality of facilities such as shops was a factor in the casual meetings between residents, an important means of keeping in touch with the community (Cattell, 2001, Cattell et al., 2008). In their examination of communities in East London in the United Kingdom, networks varied in type between those that were relatively homogenous, and closely

knit to those that were more heterogeneous, but still with cross network connections (Cattell, 2001).

The above literature closely parallels the body of work called upon in Chapter Three. There the discussion focused on the antecedent conditions for collective social functioning. Using a social topography metaphor, it was argued that the index acts as the structural antecedent to the neighbourhood social environment, by providing a more or less supportive environment for collectivity within the neighbourhood. In this way the degree of neighbourhood fragmentation provides a varied foundation for the social networks of a neighborhood.

The level of fragmentation is then hypothesized to lead to the number and intensity of the connections or networks between members of a neighbourhood. In the topography metaphor, this could be described as the roads and pathways between houses that act as a conduit for communication and transport across the neighbourhood. For example, a high number of school aged children could provide a means of communicating within the neighbourhood by enabling networks to parent residents (Witten et al., 2007), increase the number of community wide events, and may also provide a common interest or reason for the whole neighbourhood to act collectively (Sampson et al., 1999).

A number of authors have discussed the importance of social networks and connections across a neighbourhood for the development of resources such as social capital. The definition of social capital is contested (Blakely et al., 2006, Blakely and Ivory, 2006, Kawachi and Berkman, 2000, Pearce and Davey Smith, 2003) and it is not my intention to enter into a discussion of the theoretical merits of the concept. Rather the focus is on understanding how fragmentation of the neighbourhood might be an important factor to consider when examining the relationship between social capital and health.

Carpiano (Carpiano, 2006) argued that social capital was a resource arising from the networks within a neighbourhood. Calling upon the work of Bourdieu, he argued that networks in a neighbourhood (or other such group) would lead to social cohesion, that is, trust, common values, participation and so forth. A product of cohesion would be neighbourhood level resources such as informal social control, support and so on. For example, a neighbourhood that was highly socially cohesive would be able to implement informal social controls on its residents in ways that were of potential benefit (or capital) to residents (Carpiano, 2007).

This definition of social capital highlights the importance of the quality and nature of the networks within a neighbourhood, and the importance of their antecedents. Carpiano examined the structural antecedents to social capital, looking specifically at socioeconomic factors and residential stability (Carpiano, 2006). It was argued that these factors could affect the nature of the social ties within a neighbourhood and therefore the ability of a neighbourhood to produce social capital. Similarly it is argued here that the composition of a neighbourhood may be an important factor in the nature of the networks, and therefore the social capital resources that arise within a neighbourhood.

Following Durkheim's logic then, geographic neighbourhoods could arguably be influential in modern society because of their potential to be an intermediary social group between the state and the individual. Furthermore, the type of neighbourhood and the resources available from it may be an important factor in understanding the role played by the neighbourhood social group. Specifically, the index of Neighbourhood Social Fragmentation may be capturing important differences in the types of geographically based social groups.

But how would the level of fragmentation captured by the type of neighbourhood affect individuals? In order to explore this interpretation further, Durkheim's concept of the "social group" or "society" required further unpacking.

4.1.3 How do Social Groups Work?

Durkheim's interest in describing social groups was to examine the mechanisms by which social order is developed and maintained (Power and Whitty, 2002). For him, this was the key to understanding the welfare of both the individual and societies. Ideally, the social group allows individuals to live their own lives (the individual will) within boundaries provided via the collective will. A well balanced society was therefore one that is well ordered and beneficial to its constituents. He used examples of the uneven distribution of suffering at the individual and group level (for example suicide and divorce rates) to explore the imbalances within societies or social groups. Durkheim attributed the variations in, for example, suicide rates, as evidence of differences in the harmony, or balance between the power of the group and the autonomy of the individual. Thus, Durkheim's focus on the fraught and precarious balancing between the individual and collective was an important feature of this thesis (Carpiano and Kelly, 2005).

For Durkheim, individuals necessarily group together into 'societies' or social groups. Durkheim described social groups at a variety of scales. One of the smallest was the familial society based on blood ties; "...even if the married children continue to live with their parents and form a single domestic society." (Durkheim, 1951, p. 199). A larger scale example he used was that of a religious society: "But if religion preserves men from suicide only because and so far as it is a society..." (p. 171). A variety of terms have been used to describe Durkheim's societies, for example, Giddens referred to them as institutional sectors of society such as families (Giddens, 1971). In keeping with Durkheim's usage and with common practice in the recent literature the term 'social group' will be used here.

In order to understand how the neighbourhood setting could act as a social group four components of Durkheim's work will be discussed in detail; having things in common, social practices, density of the practices, and the resulting 'moral force'.

4.1.3.1 Things in Common

'Societies', or social groups, arise when individuals have an interest or characteristic that is common to the group, and that in some way distinguishes them from the rest of the population. Benefits accrue to the individual because social groups provide the opportunity to "...associate, that is, not to feel lost among adversaries, to have the pleasure of communing, to make one out of many, which is to say, finally, to lead the same moral life together." (Durkheim, 1964, p. 15).

While Durkheim focused on groups such as families and religion, he proposed that social groups could arise from a number of sources: "material neighbourhood, solidarity of interest, the need of uniting against a common danger, or simply to unite, are other powerful causes of a relationship [between individuals]." (Durkheim, 1964, p. 16). Durkheim was highlighting that while there were some more common forms (such as families and occupations), what was important was the coming together of individuals. It was also clear that Durkheim did not conceive the groups as being exclusive – in a society based on organic solidarity individuals would be members of a number of interconnected groups, at a variety of scales (Durkheim, 1964).

The importance of having interests in common has already been highlighted in the review of potential variables for the Index. A number of authors, for example, have discussed the part played by homeownership in encouraging residents to invest in a local area. They have argued that owning a home in a neighbourhood gave residents a common interest with other residents. (Franzini et al., 2005, Sampson et al., 1999). In a discussion around the impact of immigration on social cohesion within New

Zealand society, Spoonley et al (2005), highlighted the importance of developing policy which fostered common interests between migrants and host communities, rather than those which reinforced divisions. Witten et al (2001) were able to demonstrate the effect on parents and communities when a common interest, in this case the local school, was closed. For many parents the school had been an important focal point and a means of linking in with a community, because of the mutual interests of parents (Witten et al., 2001).

4.1.3.2 Social Practices.

Durkheim defined societies as social spaces where beliefs and practices common to its members are constructed and maintained. In his words - "What constitutes this society is the beliefs and practices common to all the faithful, traditional and thus obligatory." (Durkheim, 1951, p. 170). According to Durkheim, social groups were where social practices were enacted; individuals performed them in the context of the group and with reference to the group. Their shared enactment became a means by which members identify with that particular group, and distinguishes them from the rest of the population (Durkheim, 1951).

Rawls (1996) made the point that Durkheim saw social practices as the empirical means by which to observe underlying social phenomena. Rather than observing individualized actions, his work sought to demonstrate the value in observing those actions within the context of the group within which they are performed. It was argued that Durkheim's work is based on the premise that enacted social practices can only be understood within the social group because they arise from the group, and at the same time contribute to the construction of the group (Rawls, 1996). At the same time, the nature of the social group cannot be understood without understanding how it is constructed by the very enactment of the social practices within it. This emergent property (Turner, 2003) running through Durkheim's thesis gives weight to the need for researchers to observe and understand both individual

and social group properties; what individuals do both constructs and is constructed by their social group context(s) (Rawls, 1996).

Following Durkheim, Rawls (1996) argued that describing practices and rituals will tell us more about society than describing the beliefs, or in Durkheim's terms, cosmologies. This is because Durkheim saw the causal pathway as starting with the enactment of practices, rather than with the beliefs and norms used to explain them (Rawls, 1996, p. 462). But it would be wrong to say that Durkheim regarded norms and values as only arising from practices. Rather, he saw a recursive relationship between individuals' social practices and the norms of the group within which they are enacted (Rawls, 1996, Turner, 2003)

4.1.3.3 Density

However, the picture is not completed by simply describing what people do. The significance of social practices within a group was determined by their 'density' (Durkheim, 1951). In "Suicide", Durkheim compared the enactment of the social practices of two types of religious groups; Catholics and Protestants. He argued that the important difference between the two was not the nature of the practice or in the cosmologies (or beliefs) around the rituals. Instead, other differences in the types of religion would lead to a more or less dense collective life (Durkheim, 1951).

According to Durkheim, the key difference could be seen in how the religious practices of Catholicism provided a closer relationship between the individual and the Catholic 'lifestyle' (Giddens, 1971) The Protestant religious practices by contrast promoted more independence of the individual, leading to a less intense, less pervasive, and less integrated collective life. It was only when the pervasiveness of religious life was observed that the differences between the two groups could be understood. "The details of the dogma and rites are secondary. The essential thing is that they are capable of supporting an [sic] sufficiently intense collective life." (Durkheim, 1951, p. 170).

Giddens used the term “pervasiveness” to describe the term density (Giddens, 1971). As well as referring to the quantity of a social practice, Durkheim appeared to be capturing the way in which the social practices pervaded, or were part of, an individual’s daily life. A ‘denser’ enactment of social practices, for example, regularity of contact between individuals, would be more pervasive and highly visible to members of the social group.

4.1.3.4 Moral Force.

The density or pervasiveness of the social practices within a group becomes important because of the effect it has on individual group members. Durkheim argued that being frequently exposed to the practices of the collective creates a “moral force” on all members to join in (Durkheim, 1951). The effect of the density and commonness of the behaviours is to create a binding ‘moral force’ within the group and on the individual members of the group.

This seems to be a key point of difference from much social observation work where there seems to be more of an emphasis on practices being determined by norms and values (Rawls, 1996). According to Rawls, “For Durkheim, society consists first and foremost of enacted practices that give rise to the real social forces that participants in the assembled group experience jointly” (Rawls, 1996, p. 434). What is being emphasized by Rawls is that the compulsion to act arises from experience of the moral force, not what the acts are, or the norms that they represent and reinforce.

In more modern terms ‘moral force’ could be described as the norms or culture of a group. Because the norms arise from the collective practices of the constituent members, Durkheim argued that they could not be regarded as coercive: “Under normal conditions the collective order is regarded as just by the majority of persons....Since this regulation is meant to restrain individual passions, it must come

from a power which dominates individuals; but this power must also be obeyed through respect, not fear.” (Durkheim, 1951, p. 252).

It was the moral force that was the determining factor in single individuals’ enactment of a collective’s social practices (Durkheim, 1951). Rather than the more automatic process of imitation, Durkheim argued that the reproduction of social practices within a group was because of the social pressures of the context:

“The act is not reproduced because it took place in our presence or to our knowledge and because we like the reproduction in and for itself, but because it seems obligatory and to some extent useful. We perform it not merely because it has been performed but because it bears a social stamp and because we defer to this necessarily on pain of serious inconvenience. That is, *to act through respect or fear of opinion is not to act through imitation* (original emphasis).” (Durkheim, 1951, p. 127).

And why is the strength of the moral force important? Because the binding of the group through this force creates the powerful integration and regulation functions of social groups that Durkheim saw as being so necessary for a balanced life.

4.1.3.5 Homo Duplex: the Tension Between the Collective and Individual Wills

Durkheim recognized that regulation and integration were not fixed goods. It was more complex than assuming that more is always better and less always a deficit. Rather he saw it as a matter of balance between the will of the collective and the passions of the individual. He described it as the homo duplex nature of man; the need to be restrained, but not too much, by society. The distinction between regulation and integration is arguably simplistic and problematic, both theoretically and empirically (Thorlindsson & Bjarnsson, 2005). Baller (Baller and Richardson, 2002) agreed that they were distinct but also that they could not be separated.

Durkheim took some care to differentiate between the functions of the two mechanisms, but they remain intertwined in his work. Bearman (1991) regarded Durkheim's concept of integration as focusing on the nature of an individual's relationship with the group, whereas regulation referred to the nature of the group. Complexity notwithstanding, it is worth considering each separately to examine how characteristics of individuals and social groups might contribute differently to them.

4.1.3.6 Integration

The moral force acts to bind members to the group. It is this binding, or 'glue' effect that Durkheim is referring to when he speaks of the level of integration or cohesion in a group. On the few occasions when the term 'social fragmentation' was used, it described a paucity of cohesion or integration (Durkheim, 1951). As he was concerned with the level of integration, Durkheim's focus was on differences between social groups in their ability to create a strong cohesive moral force within the group.

"But for a group to be said to have a less common life than another means that it is less powerfully integrated; for the state of integration of a social aggregate can only reflect the intensity of the collective life circulating in it. It is more unified and powerful the more active and constant is the intercourse among its members. Our previous conclusion may thus be completed to read: just as the family is a powerful safeguard against suicide, so the more strongly it is constituted the greater its protection." (Durkheim, 1951, p. 202).

By comparing different types of, for example, religions and families, Durkheim proposed that we would be able to understand how some social groups were able to offer higher levels of integration than others. He sought to empirically observe

characteristics of social groups that could act as indicators of the levels of integration within the group.

When considering the case of different types of religious groups, Durkheim makes it clear that the varying levels of integration arise from the characteristics of the groups. While both religious groups had similar beliefs regarding suicide it was the differing density of practices which resulted in different levels of integration of individuals into the group. He then went on to argue that variation in suicide rates was a result of variations in the strength of integration.

“If religion protects man against the desire for self-destruction, it is not that it preaches the respect for his own person to him with arguments *sui generis*; but because it is a society. What constitutes this society is the beliefs and practices common to all the faithful, traditional and thus obligatory. The more numerous and strong these collective states of mind, the stronger the integration of the religious community, and also the greater its preservative value.” (Durkheim, 1951, p. 170).

Attempting to understand variations in the level of integration across different types of family settings, Durkheim considered the number of children in a family as being a possible (but problematic) measure. He argued that having a large number of children in a household would by necessity result in a higher density of social practices.

Rather than relying on the family size proxy, Thorlindsson and Bjarnason (Thorlindsson and Bjarnason, 1998) observed the frequency of actual practices such as communication and eating together etc. They argued that this would give evidence of how family life varied the degree to which there was, in Durkheim’s terms, an “active and constant ...intercourse” between family members, which

would results in children being more or less tightly integrated into the family unit. Thorlindsson et al (1998) observed that a higher density of binding practices (and therefore a higher level of integration) was protective against suicidal ideation and delinquency. Thus, the family that plays together, eats together etc, stays together because, according to Durkheim's thesis, the frequent, regular, interactive process of dining and playing can be described as having a high density which results in a powerful hold or cohesion on the family members, binding them together. It ensures that each individual is integrated into the social group because of the constancy of the practices of eating and playing.

In Durkheim's theory, integration into a social group provides the individual with protection from the wider world and also relieves the individual from having to make constant decisions about the world. In order for high levels of integration to have an effect on an individual the group needs to be cohesive and the individual needs to be 'captured' by the group.

"When society is *strongly* integrated, it holds individuals under its control, considers them at its service and thus forbids them from disposing of themselves." ; "...suicide varies inversely with the degree of integration of the social groups of which the individual forms a part (emphasis added)."
(Durkheim, 1951, p. 209).

4.1.3.7 Regulation

Thorlindsson and Bjarnason (1998) regarded regulation as less well researched in the recent literature, perhaps reflecting the difficulties in untangling the mechanisms. As well as integrating individuals into the social group, the collective life also provides a regulating force which acts to curtail the passions of the individual. "To achieve any other result the passions must first be limited....But since the individual has no way of limiting them, this must be done by some force exterior to him." (Durkheim, 1951,

p. 248). Durkheim regarded individuals as pathologically unable to limit their goals and passions; it is human nature to reflect on life, therefore individuals will always want more, or something better (Deflem, 1989). In Durkheim's thinking, the role of social groups was to provide limits on what can be considered 'reasonable', or in Thorlindsson and Bernburgs's terms "normative limits" (2004). The societies to which the individual belongs effectively become part of their world, along with worldviews on how the world works.

Social groups vary in their ability to regulate individuals through a strong moral force. Durkheim used the example of the disruption to a familial social group that arises from an event such as divorce: "The scale is upset; but a new scale cannot be immediately improvised....So long as the social forces thus freed are unknown and so all regulation is lacking for a time." (Durkheim, 1951, p. 253). Once the social group rearranged itself, developed new group practices and so on, a new, more protective level of regulation could be established.

The intertwining relationship between integration and regulation can be usefully explored by returning to Durkheim's concept of homo duplex, described above. Both the collective and individual dimensions are important because they tell us about the power of both the group and the individual and how the forces interact within a society. Taylor and Ashworth (1987) argued that this was an important contribution from Durkheim to the ongoing sociological debate around the relationship between individual and society.

The tensions between the collective and individual dimensions of homo duplex are represented in Figure 4:2. The vertical line represents the strength of the individual will within a social group and the horizontal line the strength of the collective will. Durkheim used the terms egoism, anomie, altruism and fatalism to describe

unbalanced states or currents within a group that could lead to various 'forms' of suicide for its members

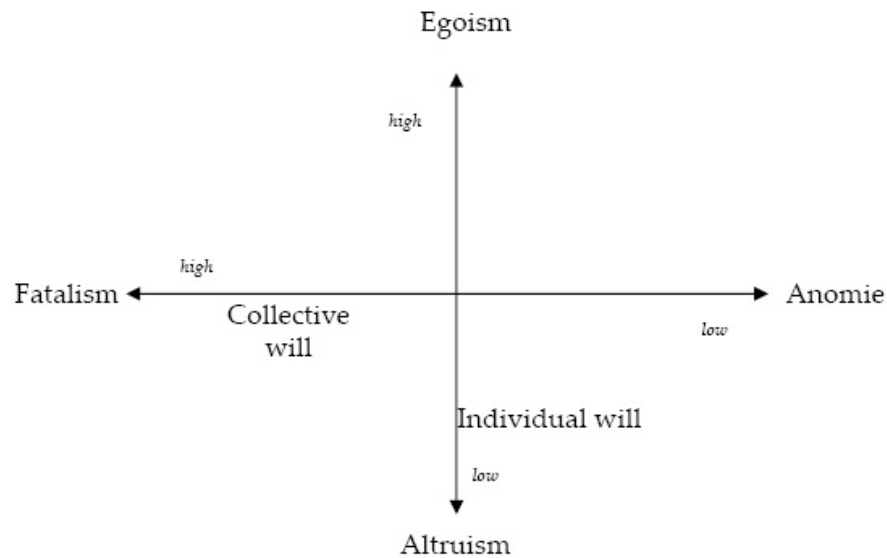


Figure 4:2 Homo duplex: balancing the tension between the collective and individual wills

At one extreme of the collective dimension was the anomic state where the weak collective provides no regulative strength for the individual, "...society's influence is lacking in the basically individual passions, leaving them without a check-rein." (Durkheim, 1951, p. 258). In an anomic type of social group the practices would not be sufficiently binding, the norms not reinforced by their practices, and the collective life of the group not sufficiently pervasive to provide protection. There is no means for the individual to be regulated by the group, even while individuals may be integrated into a group (Bearman, 1991). The processes such as urbanisation have often been referred to as anomic because of the way that they disrupt the ability of the collective to regulate and integrate the individual (Acevedo, 2005).

Durkheim argued that anomic currents arise when social groups undergo some sort of crisis, leading to a disruption in the normal order. Until a new order is created, the social group is unable to provide the regulation required by individuals (Durkheim, 1951). Another way of considering inadequate regulation or anomie is when the order, or regulation, is not visible or attainable to its members (Deflem, 1989).

Opposite to anomie is the fatalistic state, which was less developed in Durkheim's work (Bearman, 1991, Kushner and Sterk, 2005) (In fact it was relegated to a footnote in *Suicide*). Here the individual is over-regulated and subsumed to the collective will; the individual sees no other way. Durkheim used the example of slavery or oppressive familial structures to describe social groups with strongly fatalistic currents; "...that of persons with futures pitilessly blocked and passion violently choked by oppressive discipline." (Durkheim, 1951, p. 276).

On the individual dimension, egoistic currents in a society would result in the individual being poorly integrated into the collective body; not so much because the collective is weak as in anomie, but because the individual will is able to be so strong. The individual is less captured by the moral force of the group (even though it may be strong) and is therefore not integrated into the collective body: "...in which the individual ego asserts itself to excess in the face of the social ego and its expense, we may call egoistic the special type of suicide springing from excessive individualism." (Durkheim, 1951, p. 209). Thus, Durkheim regarded the Protestant religion to be more egoistic (than Catholicism) because the nature of the religious practices was such that the individual was less dependent on the priest and church for their understanding of religion and in their daily life.

And opposite to egoism is the altruistic state where the individual's will is so weak as to be discounted before the needs or control of the collective. Durkheim saw suicides that came from an over developed sense of duty to the group as being

examples of altruistic suicide. "For society to be able to thus compel some of its members to kill themselves the individual personality can have little value..." (Durkheim, 1951, p. 220).

As captured in his concept of homo duplex, Durkheim stressed the need for balance between the competing needs of the individual and the collective within a social group. Therefore a primary function of a social group was to establish a 'healthy' equilibrium between the three currents of egoism, altruism and anomie (and Kushner et al (2005) and I would add fatalism);

"This is why there is no people among whom these three currents do not co-exist, bending men's inclinations in three different and even opposing directions. Where they offset one another, the moral agent is in a state of equilibrium which shelters him against any thought of suicide. But let one of them exceed a certain strength to the detriment of the others, and as it becomes individualized, it also becomes suicidogenic, for the reasons assigned." (Durkheim, 1951, p. 321).

According to Durkheim's theory then, social groups vary in their ability to balance the competing needs of their members and of the group. The nature of the imbalance, the extent to which it is weighted towards the individual or the group, will have consequences for the well being of individual members.

Durkheim's theory of social groups has provided a means of comparing types of social groups in today's society. I have argued that the geographic neighbourhood could potentially act as an intermediary social group between the individual and the wider world, but also that not all neighbourhoods are the same. In Durkheim's theory, social groups are an important source of influence for individuals. Social groups are where social practices are enacted, and where individuals experience

integration and regulation. It is this binding between the individual and the group that is generally now referred to as social cohesion, or in some schools of thought, social capital. However, Durkheim did not regard individuals as passive recipients of the social setting; rather the social group is constructed by the interactions of the individual members. Durkheim's explanation of the integration and regulation has therefore provided a useful means of describing variations in the types of neighbourhood social groups. The attention now returns to NeighFrag, bringing the theory proposed above together with the data (NeighFrag).

4.2 How Would the Index of Neighbourhood Social Fragmentation Matter?

The second section of the chapter turns back to the Index of Neighbourhood Social Fragmentation, bringing the empirical measure together with the theory outlined above. The section aims to establish specifically how neighbourhood social fragmentation, as measured by the index, might be related to individual health. The first part of the section describes how the index might be capturing neighbourhood types with differing levels of integration and regulation. Two mechanisms will be proposed as a means of explaining how NeighFrag might matter: 'integration and regulation' and 'transmission'. The health consequences of each mechanism are then discussed in the final part of the section.

Understanding how NeighFrag might be capturing different types of neighbourhoods can be understood by returning to the ecological model proposed earlier. Adding Neighbourhood Fragmentation to the neighbourhood layer adds another dimension. The degree of fragmentation of a neighbourhood can mean that a neighbourhood can act as an intermediary layer to varying degrees. In Figure 4:3 the degrees of neighbourhood fragmentation are illustrated by the transparency of the neighbourhood layer. The middle of the neighbourhood layer represents a balance between the strength of the collective and individual within the neighbourhood

social group. The neighbourhood setting acts as a filter to the wider world, and provides normative limits to the individual, but the neighbourhood setting is not the only influence in an individual's life. In the top of the neighbourhood layer, the neighbourhood setting (represented by the orange colour) is less visible. That is to say, the influence of the wider world and individual characteristics are less moderated by the neighbourhood setting. At the bottom of the neighbourhood layer, the neighbourhood setting is more visible, suggesting that neighbourhood life has a stronger presence in the life of residents.

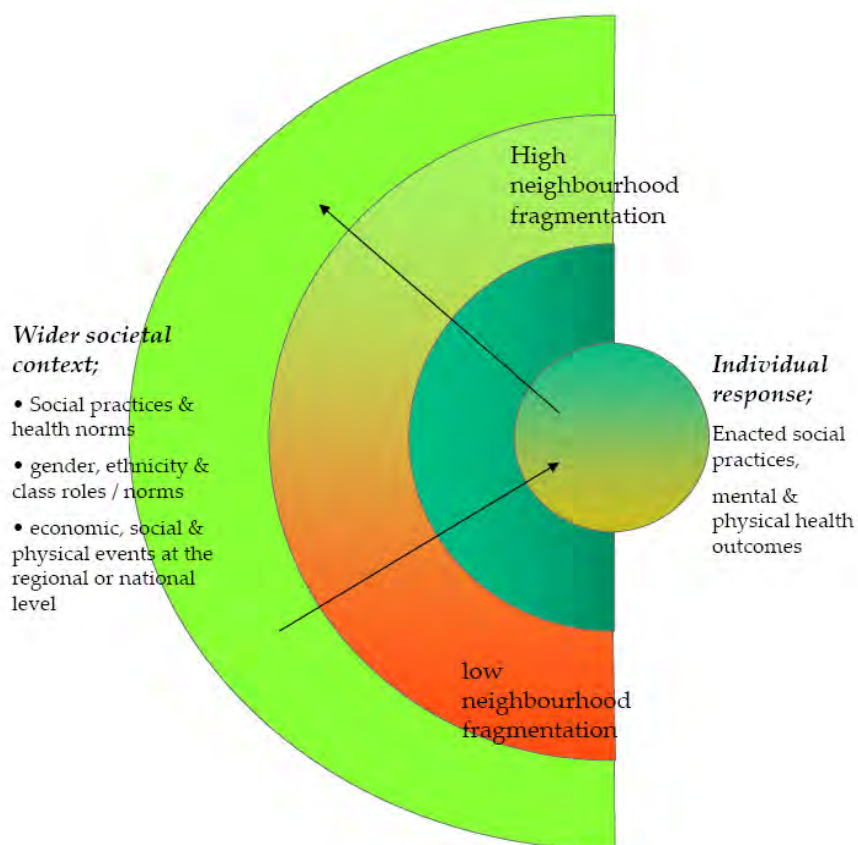


Figure 4:3 Degrees of Neighbourhood Social Fragmentation]

Two potential mechanisms are suggested for explaining the impact of fragmentation on the role of the neighbourhood in individual health, that of integration and regulation and the transmission of social practices. In the first mechanism, Durkheim

argued that an important function of the social group was to filter the stresses and strains of the wider world, and to provide 'normative limits' to individual passions. An imbalance would leave individuals under psychological stress. As illustrated by the transparency of the neighbourhood layer, in a highly fragmented type of neighbourhood the individual is comparatively "exposed" to both the world and his or her own "passions". The neighbourhood is less able to provide a visible regulating order to residents, leading to anomie. In such a setting the "normative limits" from the neighbourhood social group would be less visible and weaker; the individual is left to their own devices. The highly fragmented neighbourhood could therefore leave the individual vulnerable to their own "passions". It may also be less able to integrate the individual into the neighbourhood collective (leading to egoism). Neighbourhood settings that are highly fragmented may be less able to buffer its residents from forces either internal or external.

By contrast, in a less fragmented neighbourhood (represented by less transparency) events, practices, values and so on are filtered and possibly modified in nature by those present in the neighbourhood. The neighbourhood more strongly moderates the impact of the world and provides stronger "normative limits" to the individual. At an extreme level, the 'normative limits' from the neighbourhood would be so strong as to override the individual will (fatalism) and the individual would be so captured by the neighbourhood collective that own their own needs become secondary (altruism).

The second mechanism focuses on the transmission of social practices within neighbourhood social groups. NeighFrag may represent different types of settings where the influence of the collective on the social practices of the individual varies. It is proposed that within the highly fragmented neighbourhoods practices are less likely to be transmitted between residents and local practices will be less influential on residents. Comparatively speaking, what goes on in the wider world or within the

individual would be more influential in understanding the individual response than what happens in the local neighbourhood (again illustrated by the degree of orange in the layer). That is, the type of a neighbourhood (characterized by the level of fragmentation) could determine the extent to which social practices of residents are more pervasive in the lives of other residents – and therefore the extent to which they become common.

Using a hypothetical example, it might be observed that a social practice such as seat belt use varies from one neighbourhood to another. A number of factors will be determining individual seat belt use and often those factors also vary by neighbourhood. But the neighbourhood environment may also be important in determining the level of other residents' influence on individual seat belt use: an individual in a neighbourhood with close networks and with high levels of seat belt use is going to be more exposed to protective seat belt use than someone in a neighbourhood with high levels of seat belt use but with low levels of networks. Therefore the effect of others' behaviours is going to be stronger in a neighbourhood where residents are more exposed to the practices of other locals.

Following on with Durkheim's argument, the visibility and commonness (or density) of the social practices leads to the strength of the "moral force" around the enactment of the practices. In neighbourhoods with low levels of fragmentation, the moral force that arises from the frequent and constant contact between residents creates a strong binding force across the neighbourhood. Conversely, high levels of fragmentation would lead to fewer opportunities for residents to be influenced by their neighbours' social practices, or for a cohesive environment across the neighbourhood, and therefore for individuals to be drawn into neighbourhood life.

In such egoistic neighbourhoods, residents live lives more independently from the collective; in Durkheim's term they are less captured by the neighbourhood. In

highly fragmented neighbourhoods we would also expect to see a greater influence of wider world and individual characteristics compared with local practices. The more fragmented type of neighbourhood represents an imbalance between the individual and collective wills: in Durkheim's terms a highly fragmented neighbourhood would be less able to regulate individuals' practices (anomie), and provide fewer constraints on a more egoistic lifestyle for those with a strong personal will.

4.2.1 Health-related Mechanisms

Two potential health-related mechanisms between the type of neighbourhood social group and individual health have been described from the theoretical model posed above. Firstly, as argued above, different types of social groups potentially provide varying degrees of supportive regulation and integration. In Durkheim's view, a balanced level of integration and regulation is necessary to the well being of individuals; too much or too little would leave the individual under psychological strain, and unable to act in their own best interests. Therefore, if different types of neighbourhoods offer varying levels of integration and regulation, there may be consequences for the well being of individual residents.

Secondly, social groups are sites where social practices are enacted. But the degree of integration and regulation in a social group will affect the strength of the moral force associated with the enactment of social practices. According to Durkheim's logic, in strongly integrated and regulated social groups, individuals will be more strongly bound to adhere to the group practices (that is the practices of other individuals). Conversely, in a less integrated and regulated environment, the group practices will have less influence, or exert less moral force over an individual's practices. It would therefore be expected that non-neighbourhood levels of influence such individual, family, and work place characteristics, would be stronger.