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Land use mix and five-year mortality in later life: Results from the Cognitive Function and Ageing Study

Yu-Tzu Wu [a,*], A. Matthew Prina [a,b], Andy Jones [c], Linda E. Barnes [a], Fiona E. Matthews [d], Carol Brayne [a], MRC CFAS [e]

[a] Department of Public Health and Primary Care, Institute of Public Health, Forvie Site, University of Cambridge, School of Clinical Medicine, Cambridge Biomedical Campus, Cambridge CB2 0SR, United Kingdom
[b] King's College London, Institute of Psychiatry, Psychology and Neuroscience, Centre for Global Mental Health, Health Service and Population Research Department, De Crespigny Park, Denmark Hill, London SE5 8AF, United Kingdom
[c] Norwich Medical School, University of East Anglia, Norwich, Norfolk NR4 7TJ, United Kingdom
[d] MRC Biostatistics Unit, Institute of Public Health, University of Cambridge, Cambridge CB2 0SR, United Kingdom
[e] Medical Research Council Cognitive Function and Ageing Study, United Kingdom

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ABSTRACT

This study explores the potential modifying effect of age and mediation effect of co-morbidity on the association between land use mix, a measure of neighbourhood walkability, and five-year mortality among the 2424 individuals participating in the year-10 follow-up of the Cognitive Function and Ageing Study in England. Postcodes of participants were mapped onto Lower-layer Super Output Areas, a small area level geographical unit in the UK, and linked to Generalised Land Use data. Cox regression models were fitted to investigate the association. For the younger older age group (75–79 years), the effect of high land use mix on an elevated risk of mortality was mediated by co-morbidity. For older old age groups (80–84, 85+ years), a higher land use mix was directly associated with a 10% lower risk of five-year mortality. The findings suggest differential impacts of land use mix on the health of the younger and older old.

1. Introduction

In the UK, it is estimated that older people spend over 80% of the time in home or surrounding neighbourhoods (Age UK, 2015; Phillipson, 2012) and they largely rely on local services and resources such as post offices, banks, supermarkets and parks (International Longevity Centre UK, 2014; Harrop and Jopling, 2009). Access to these services has been examined in a recent analysis of the English Longitudinal Study of Ageing (ELSA), which highlighted difficulties in travelling far to a range of key services (banks, hospitals, post offices and supermarkets) for those aged 80 or above due the difficulties of obtaining transport (Holley-Moore and Creighton, 2015). Since walking and the use of public transport are the principal modes of travel in older age (Help the Aged, 2008; Holland et al., 2005), providing a supportive environment with nearby services may have mobility and consequent health benefits in this population (Holley-Moore and Creighton, 2015).

A range of environmental characteristics in local areas are thought to be important for active ageing and good health in later life (Annear et al., 2012; Yen et al., 2009; World Health Organisation, 2002). In particular, the diversity of land uses has been identified as being related to physical activity and mobility in older adults (Van Cauwenberg et al., 2011; Rosso et al., 2011; Li et al., 2005). Areas with high levels of land use mix generally indicate better access to local services and resources and have been shown to increase capabilities of older people to cope with basic needs (Rosso et al., 2013), encourage outdoor activity (Clarke and Nieuwenhuijsen, 2009) and enhance social engagement (Leyden, 2003) with potential benefits on physical and mental health in later life.

The conceptual framework in Fig. 1 shows potential pathways linking land use mix to mortality. High land use mix is known to be a protective factor for physical inactivity and obesity (Jones et al., 2007; Mackenbach et al., 2014), which have in turn been related to several chronic conditions such as diabetes, hypertension and cardiovascular diseases (Durstine et al., 2013; World

* Correspondence to: The Centre for Research in Aging and Cognitive Health Department of Psychology, College of Life and Environmental Sciences, University of Exeter, Washington Singer Building, Perry Road, Exeter EX4 4QG, United Kingdom.
E-mail address: y.wu3@exeter.ac.uk (Y.-T. Wu)
URL: http://www.cfas.ac.uk (MRC CFAS)

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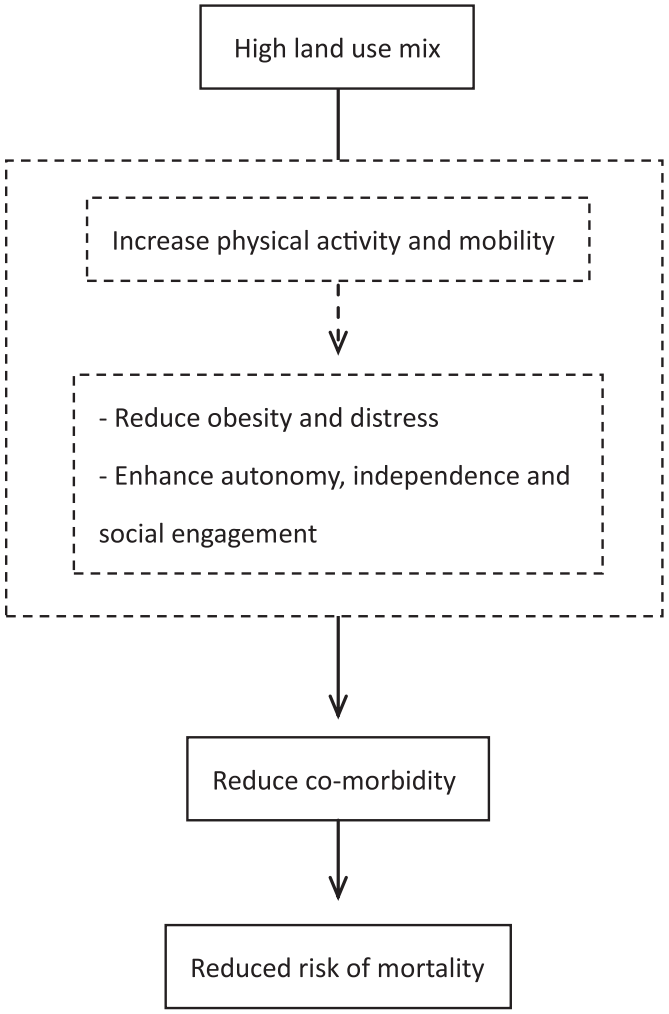

Fig. 1. A conceptual framework of pathways linking land use mix and mortality. Dashed line: this study does not address these factors.

Health Organisation, 2015). Being able to access services and cope with basic needs may also enhance independent living and social interactions (Holland et al., 2005), with potential psychosocial effects on mental well-being, quality of life as well as the development of chronic conditions (Almedom, 2005; Bowling, 2005; Hawkley and Cacioppo, 2003). These behavioural and psychological factors might influence the occurrence of co-morbidity, which is a strong predictor for reduced life expectancy and mortality (Lozano et al., 2012) and a potential mediator in the association between land use mix and mortality.

Most of the existing studies on older people have actually focused on "young old" those aged 60–74 years old with relatively good health, functional ability and social engagement compared to the "middle old" (75–84) and "oldest old" (85+) (Zizza et al., 2009). Despite showing resilience through survival, the middle and oldest old are more likely to experience frailty and illness (Baltes and Smith, 2003; Tomassini, 2006) and can be sensitive to stress from local environments (Lawton and Nahemow, 1973). For example, areas with mixed commercial, industrial and residential land use are often situated in the inner-urban core and their residents may be exposed to higher levels of common urban stresses such as social disorder, noise and concentrated poverty (Grant et al., 2009; Wikström et al., 2012). Indeed, a small number of studies have reported a potential negative effect of high land use mix and environmental stress, particularly on the mental health in older people (Saarloos et al., 2011; Knipscheer et al., 2000). However, few studies have explored changing relationships between the environment and health at different stages of ageing.

In order to provide a better understanding of ageing and place, this study aims to investigate the influence of land use mix on five-year mortality in a very old population cohort aged 75 and over in England. The analysis explores the potential modifying effect of age and mediation effect of co-morbidity on the longitudinal association between land use mix and mortality.

2. Method

2.1. Study population

The Medical Research Council (MRC) Cognitive Function and Ageing Study (CFAS) is a longitudinal population-based study investigating the cognitive and physical decline of people aged 65 and over in six centres across England and Wales (Liverpool, Cambridgeshire, Gwynedd, Newcastle upon Tyne, Nottingham and Oxford). Identical study designs and measurement methods were used at each centre except Liverpool, which is excluded from many CFAS analyses as well as the work presented here.

Full details of CFAS have been described elsewhere (Brayne et al., 2006). In brief, community and institutionalised populations were sampled from General Practice Registers in order to capture equal sized samples of those aged 65–74 and 75 years and over. Baseline interviews were conducted between 1991 and 1994 and delivered by trained interviewers visiting participants' residences. Among the 16,258 individuals invited for the study, 13,004 completed the initial screening interview with a response rate of 80%. The follow-up wave was conducted after 2 years from the baseline and then focused on sub-samples every two years after the 2 year with a 10 year follow-up on all survivors and responders.

Due to limited environmental data from the 1990s, this study focused on the 10 year follow-up in 2001. As comparable environmental data at the small area level are not available for Wales, the four identical English centres (Cambridgeshire, Newcastle upon Tyne, Nottingham and Oxford) were used in this analysis.

2.2. Individual level measurements

Mortality was the outcome of interest in this study. Date of death for the CFAS participants was available from linkage to national death certification. The information was used to identify deaths within five years from the year-10 interview (i.e. from the beginning of 2001 to the end of 2005) and calculate survival time. The choice of five-year endpoint was based on the consideration that exposure to environmental characteristics may vary significantly over longer time periods and hence relationships with mortality could be obscured.

Individual socio-demographic factors including age, gender, education and social class have been shown to be consistently related to general health and mortality risk and may confound associations with land use mix (Marmot et al., 1991; Tiainen et al., 2013; Kulhánová et al., 2014). Age was categorised into three groups: 75–79, 80–84 and 85 or above. Education was divided into "high" and "low" groups based on the CFAS study protocol which differentiated people with nine or fewer years of education from those with ten years or above (Brayne et al., 2006). The lifetime longest occupation reported in was used to classify social class of each participant according to the Registrar General's occupation-based social class (Office for National Staistics, 1990). The participants were then grouped into four groups: professional/managerial (social class I and II), skilled non-manual (IIINM), skilled manual (IIIM) and semi-skilled/unskilled (IV and V).