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Mobility as a Service for the older population: a transport solution to land use changes in essential services?

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TITLE: **Mobility as a Service for the older population: a transport solution to land use changes in essential services?**

ABSTRACT: Land use changes in relation to everyday services are resulting in centralisation of local services from mixed land use town centres to single land use destinations on the edge of cities. Technology advances are disrupting the provision of local community services such as local shops and local health care. Cost considerations and the benefits achieved by economies of scale are driving the land use changes which are changing the landscape of service provision. Whereas hospitals, for example, were typically located in city centres they are now more often in peripheral locations. For many sections of society, these changes have offered better convenience and higher quality of service. However, these changes have both spatial and horizontal equity impacts, particularly for older people and particularly for areas of lower density where accessibility will significantly decline. This paper explores the potential contribution of Mobility as a Service (MaaS) in promoting greater equity for older people using Community Transport (CT) as the service co-ordinator. The travel needs and behaviour of older people are reviewed as well as the contribution of flexible transport services towards meeting these needs. Drawing on discussions with a group of CT operators in Australia the key characteristics of the MaaS model are explored in the context of older people to ascertain whether CT acting as the service co-co-ordinator fits the MaaS model. A series of MaaS packages are proposed to show how the model could be delivered in practice. The paper concludes that as a business model, MaaS for CT could be one way of ameliorating the lack of equity for the old and frail age group brought about by land use changes in essential services.

KEY WORDS: *Mobility as a Service (MaaS), Community Transport, land use changes, equity impacts, travel behaviour of older people*

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Introduction and background

Land use changes in relation to everyday services are resulting in centralisation of local services from mixed land use town centres to single land use destinations on the edge of cities, predicated often on motorised access. New shopping centres and new hospitals are not built in city centres where walking access might be possible because there is not the land available, but are instead built in peripheral locations creating single land use destinations on the edge of cities. Access to services are thus being affected by changing land use which in turn has knock-on effects on transport needs for different sectors of the population.

Technology advances are disrupting the provision of local community services; e.g. the growth of internet shopping and banking has resulted in the closure of many local shops and services so that it is only the larger (often out of town) shopping centres that are available for face to face shopping. The advances in expensive hi-tech medical equipment and the better outcome for patients through treatment by specialists (e.g. orthopaedic surgeons specialising in a particular joint, or one part of the body) has prompted the centralisation of many types of medical care to specialist centres resulting in closure of much of the distributed local medical care that is not considered as primary health. In short, cost considerations and the benefits achieved by economies of scale are driving the land use changes which are changing the landscape of service provision. For many sections of society, these changes have offered better convenience and higher quality of service. However, mixed land use (as was found when hospitals, for example, were in city centres amongst shops and workplaces) have been shown to be a factor in healthy aging. A study looking at the relationship between land use mix and mortality in later life concluded that citizens over 75 had a 20% lower risk of mortality if they lived in highly mixed land use surroundings as compared to the lowest mix of land use (Wu et al 2016).

Nevertheless, these changes have both a spatial equity and a horizontal equity impact. Spatial equity because the accessibility to destinations and facilities has changed as a result of location changes: for regional and rural areas, particularly where density is lower, the access to new centralised destinations is reduced and citizens in more dense areas will have a better access than those in less dense areas (Haynes and Bentham 1982). Not surprisingly, given our understanding of transport models, the access distance to a facility will suffer from 'distance decay' so that this spatial inequity leads to horizontal inequity since differences in spatial access are reinforced by the lower incomes of more rural residents. But it is not only more rural dwellers that potentially suffer from the centralisation of services. Older people are citizens who are particularly adversely affected by the centralisation of local services and are typically less attuned to the possibilities of on-line services (e.g. in terms of health), thus finding physical access to centralised health care more difficult, at a life-cycle stage

when the need is likely to be greatest. Although older people are now driving until later in life (Lynott and Figueiredo, 2009), those older people who cannot drive are usually more aged and more frail than before (often called the ‘old old’).

Against this background of centralisation of services, this paper considers the equity impacts on the older and frail population. The evidence draws on the experience of the UK and Australia since it is in these two countries that Community Transport has emerged to serve the older and more frail population unlike the paratransit of the US which is underpinned by the disability legislation. The paper then proposes a Mobility as a Service (MaaS) solution to this change in land use which has led to the delivery of essential services in areas of lower land use mix. The paper then considers whether this mobility solution would be effective which in turn would provide greater horizontal equity for older members of our society.

Travel needs and behaviour of the elderly

It is well known that the population of developed countries, in particular, are aging. In most OECD countries the proportion of people aged 65 years or older is expected to increase by at least 50% by 2050 (from 2010 levels) and the ‘old-old’ proportion of the population (those aged 80 years or more) is expected to at least double by 2050 (from 2010 levels) (Colombo et al, 2011).

This section looks at trip-making by older people and how centralisation of local services is changing their travel needs.

Trip-making and their purpose

While the general trends of older person’s travel activity is rather universal across developed nations, the specific parameters differ between countries due to, for example, differences in license renewal policies, bus subsidies and levels of provision, socio-economic or other background variables (Rosenbloom, 2001). Whilst the evidence is now somewhat dated, the literature gives typical trip making behaviour for over 65’s as an average of over 3 trips per day which is a higher rate of trip making than people aged in their 20’s in the UK¹ while data from Australia reiterates this finding (Alsnih and Hensher 2006, p 906). Of course, for the older population, lifestyle changes bring with it changes in trip purpose. Retirement means a reduction in commuting trips but this appears to be compensated by making more trips for other purposes. Evidence from the UK and Denmark shows people aged between 60 and 80 make more shopping and personal business trips (this includes trips to/from banks, churches, doctors and hospitals, hairdressers and libraries) than younger age groups

¹ <http://www.ageuk.org.uk/latest-news/archive/older-people-travel-the-most/>

(Mackett, 2014; Siren and Haustein, 2012). Indeed, in the UK the over 70's are making double the number of trips for both shopping and personal business than those in their 20's (NTS, 2015). This is largely explained by their greater need to access health services and the fact that they tend to buy groceries more frequently but in lower volume as they find heavy loads more difficult.

Rates of trip making start to reduce for those aged 80 and above and drops substantially for those over 85. Holley-Moore and Creighton (2015) highlight there is a marked increase in difficulty in making essential trips for those aged 80+ compared to those in their 60's and 70's. For example in 2012 48% of people aged 80 and over in England found it difficult to travel to their nearest supermarket compared to less than 20% of those aged 70-79. Those who found it difficult to access hospital increased from 25% for 70-79 year olds to 54% for those aged over 80. This is a consequence of a sharp fall in driving ability compounded by increased mobility difficulties.

How older people travel

Public transport use by older people is low across developed nations: In the US only 2.2% of all trips were made by public transport by over 65s and only 9% of trips by non-drivers over 65 were made by public transport (Lynott and Figueiredo, 2009). In England, despite free travel, only a third of over 60s use the bus more than twice a month, while 43% claim to use it less than once a year or never². In Denmark the proportion of trips by public transport remains relatively low (<5%) for those aged under 75 (Siren and Haustein, 2012). Approximately 50,000 people aged over 85 in England are restricted to using public transport and have difficulty walking even a short distance, yet 80% of them do not use public transport. This indicates that current public transport provision is not meeting the needs of those who need it most (Holley-Moore and Creighton, 2015). With public transport use so low, trip making by car is how many older people access those destinations that are needed to participate in society. In the USA, the National Household Travel Survey (NHTS) recorded 89% of older men (65+) as drivers, compared with 73% of older women (Lynott and Figueiredo, 2009). In Denmark, for the most common trip purpose (shopping/service trips) 70% of men 65-69 make these as car driver (42% of women), but there is a marked drop to 57% of men and only 15% of women aged 80-84 (Siren and Haustein, 2012). Looking to the future, Whelan et al (2006) suggest that by 2026, almost 100% of older men and between 60–90% of older women in developed countries will enter their retirement years as car drivers.

Impact on spatial and horizontal equity

Older people cite lack of direct transport as their biggest barrier to accessing destinations (Mackett, 2014). Losing the ability to drive makes direct access to local destinations more difficult, but the

² National Travel Survey 2015-Table NTS0621

centralisation of destinations for services, particularly shopping and health destinations, makes direct access considerably more difficult. The locations of these centralised sites tend to be on the edges of large cities where land is available but where public transport access is poor, rather than the city centres. The longer travel distances involved places additional and difficult demands on friends and family member's time for lifts and eliminates taxis as an affordable other option. The loss of direct transport to these key goods and services will impact disproportionately on the 'old-old' population as shopping tends to be one of the most frequent trips and health care is likely to be more needed in the twilight years of life. Loss of mobility for the increasing numbers of 'old-old' increases the risk of isolation and associated health issues such as anxiety and depression (Musselwhite and Haddad, 2010).

Flexible transport for the elderly and frail

Community Transport (CT) in the UK, US and Australia provide many of the services the 'old-old' population increasingly need. CT in those countries where it exists grew out of a community reaction to inadequate public transport services for specific groups in the community (Denmark and Stevens 2016). The sector has become somewhat formalised in many countries and is now largely involved in direct service delivery for the aged and frail, supported by government grants. The centralisation of destinations for services has led to increased demand for CT services.

This short paper has been motivated by considering the outcome of the CT sector in Australia undergoing significant reform. The plans are to transfer the current subsidy, typically paid in the form of a block grant, to a system of person centred package payments (or PCF: person centred funding) where the package covers all the home care services required (for example, cleaning, gardening, day care and transport). These plans will require the CT sector to think differently about what they offer to their clients as the block grant disappears and subsidy is in the hands of the client.

CT organisations in Australia could be left in a position where they receive no secure funds and need to compete with other mobility providers as well as other home care services for funding from individual clients. This is likely to result in a very uncertain and most likely an unsustainable future. Another option is for CT organisations to position themselves as an agency provider offering subscription mobility packages to PCF clients. This approach adopts many features of the Mobility as a Service (MaaS) business model and may offer security to the CT sector by locking in clients as well as allowing internal cross subsidy of the trips provided.

Flexible transport services provided under a MaaS approach might also appeal to community based transport in the US (where it is called paratransit and provided under a legislative framework) or in the UK (where by and large no subsidy is offered). However, the approach of this short paper has

been inspired by looking for a solution to the reform issues proposed for Australia together with the greater transport needs brought about by the land use changes in essential services.

The MaaS approach

This section considers if and how CT groups could move towards a MaaS business model and what form of delivery would be feasible for them, their transport providers and their consumers/passengers.

MaaS is a new concept that offers consumers ‘better choice’ in how they currently travel. The emergence of new shared mobility services, alongside traditional public transport, is resulting in a wider range of alternatives to private car use. However, many of the newer sustainable transport modes operate in a largely unconnected fashion with separate tickets, payment, booking and mobile apps. The contribution of MaaS is to provide the missing collaboration and integration between transport providers enabling the user (traveller) to engage with a single service provider to coordinate and facilitate their mobility needs (Hietanen, 2014). MaaS systems to date have been proposed/planned to offer attractive alternatives to car driving for the millennial generation (16-40 year olds) of urban dwellers in large cities, where driving and parking for many trips is becoming increasingly inconvenient and expensive. The business case argument is that abandoning a car releases considerable funds to purchase alternative mobility options offered as a package of services through technology apps³.

Older and frail citizens who cannot drive, who are unlikely to be smartphone users, and who are largely unable to use conventional public transport may not appear to be suitable candidates for a MaaS type solution. However, the key characteristics of the MaaS model according to the MaaS Alliance are transport on demand; a subscription service; and potential to create new markets. This allows for different forms of MaaS services and means of accessing these services and this paper contends that a MaaS solution is possible for the older and frail citizen market. The next subsections examine the three key characteristics of the MaaS model in turn, and consider whether MaaS for aged frail fits this model and how it could be delivered in practice.

Transport on Demand – Coordination and arranging suitable transport

Under the conventional MaaS model the coordination process is achieved through technology solutions; with (open) data on transport service availability and cost of use consumed by the MaaS system; users/travellers then engage with the MaaS system through a smartphone app to query their travel options. For older citizens, a technology centred solution is unlikely to be either feasible from a

³ See for instance Ubigo in Gothenburg (<http://www.ubigo.se/>), MaaS Global in Helsinki (<https://maas.global/>) – now branded as Whim (available from whimapp.com), and MaaS-London (<http://www.bartlett.ucl.ac.uk/energy/docs/fs-maas-compress-final>).

provider side, or useable from a passenger side. MaaS for aged frail will require far greater human interaction. CT providers know their client base well and so are ideally placed to take on the role of MaaS provider to the older population, delivering a coordination role to link older passengers to the most suitable transport service; be it their own door-to-door bus or community car service, volunteer driver service or a service from another operator (including Taxi, Ridesourcing, Carpooling).

Subscription Services for Payments

The second key characteristic of MaaS is the subscription service. Subscription services are now common in other sectors such as telecoms and TV/film (MaaS has been portrayed as a Netflix style or mobile phone transport service⁴).

In the trial and early release of conventional MaaS systems, the subscription services have conventional public transport (usually unlimited use) as the basic service, and then include access to other mobility services where the type and quantity of use is either chosen by the user in advance or is billed on a pay-as-you-use basis at the end of each month. For the aged frail it is more likely that a door-to-door service provided by the CT operator could form their basic mobility service but with conventional public transport use (for those where it may be possible) as an add-on, and other door-to-door service options (e.g. Taxi, Ridesourcing, Carpooling) for trips where the basic service cannot be used (e.g. due to time of day, for locations not served, or when CT service is at capacity). Other add-ons could include travel training, for example.

Recent discussions with CT clients in New South Wales (Australia) and Queensland (Australia) have revealed that clients clearly prefer the status quo. This allows clients to take subsidised services provided by CT operators. However, when encouraged to think about the “new world” of PCF four packages emerged to treat the different needs of the clients: these are shown as monthly packages in Table 1. Package 1 would be aimed at the more active of the older and frail community whereas Package 2 would aim at the older person who had significant need for medical appointments. Clients also identified the need for emergency access to (usually) medical care which was not predicatable and this led to the inclusion of 4 emergency taxis over an annual period. Package 3 was seen as a minimum package and Package 4 was seen as appropriate for a relatively active person who wanted the security of an emergency trip. The discussions highlighted the need for flexibility in allowing clients to move between packages as they grew older and/or their needs changed. The CT organisations were recognised in the discussions as a “trusted third party” to whom they would be willing to devote the part of the PCF which is designed for meeting mobility needs. In principle, therefore, it would appear that a subscription service could appeal to the client.

⁴ <http://www.ibtimes.co.uk/sell-your-car-subscribe-netflix-style-transport-service-says-helsinki-start-maas-1560548>

Table 1: Monthly mobility packages emerging from discussions with CT clients (November 2016)

<i>Package 1</i>	<i>Package 2</i>	<i>Package 3</i>	<i>Package 4</i>
4 x shopping bus (group)	2 x shopping bus (group)	1 x shopping bus (group)	2 x shopping bus (group)
4 x social outings (group)	2 x group social outings (group)	1 x medical transport (individual)	4 x social outings (individual or group)
	6 x medical transport (individual)		1 x medical transport (individual)
	4 x emergency taxi**		1 x emergency taxi**

** emergency taxis are provided on an annual basis (so 1/12 of the cost would be allocated each month)

From the CT provider perspective the subscription model provides a mechanism by which clients (and their PCF) can be attracted and locked in to ensure a degree of certainty in revenue generation to fund the operation and management of the services they provide. The model can allow for an administration overhead to be included in the package to cover sourcing different providers. Discounted rates may be secured from alternative service providers in the longer term (buying in bulk and selling on separately). There may also be the possibility that the CT provider acquires further income from retention of any unspent travel allowances at the end of each month, if it does not roll-over to the next month.

Potential to create new markets

The third key characteristic of MaaS is the potential to create new markets. Increasing numbers of older car drivers (over 75), who stop driving due to deterioration in health have had no previous experience of using public transport services or CT services and view transportation alternatives as limited or non-existent (Donorfio et al., 2008). It is important to engage with these older car drivers and give them experiences of travelling by alternative means before their deterioration in health. Whilst many older adults are very aware of age-related changes to driving and so have time to experience alternatives in a gradual transition, there is an absence of organisations providing targeted information to help decision making in this sphere. This gives an opportunity and a need for CT operators to provide resources, information and training programmes to assist a smooth transition from driving to non-driving. A subscription package developed for car drivers over 75 which includes driver transition training, options to include excursions/group trips, and a variable km allowance of

CT travel could help facilitate a gradual transition from car use to CT travel. Annual licence renewal medical assessments for over 75s provide an ideal opportunity to signpost older drivers towards a driver transition program offered via a MaaS subscription.

As the 'old' old population (those over 80) increases, the demand for door-to-door CT services will also increase. With an ever increasing demand on CT services there is a need to increase supply in order to maintain a reasonable level of service. As highlighted previously there is a large and rapidly growing number of car-drivers between the ages of 65 and 75 who are retired from work, are healthy, have spare time and many are competent users of smart phones and apps. While these people do not yet need to use CT services for their trips, they could be encouraged, through a package of rewards, to provide an increased supply of transport in a structured way either as volunteer drivers, carpoolers sharing their trips to activities other older persons attend or even as Uber drivers if they are interested in making some extra income in retirement.

Conclusions

Technology advances are reducing the demand for local distributed shops, banking and medical services. This is resulting in centralisation of local services from mixed land use town centres to single land use destinations on the edge of cities. These land use changes are creating inequity for those that most require face to face service delivery, in particular, older citizens who traditionally benefit from mixed land use surroundings, especially as their mobility horizons diminish. These citizens have least access to virtual services and have most need for regular medical care. To combat these spatial and horizontal inequities, improved transport giving more choice of door-to-door options, at convenient times and affordable fares, is required to provide physical access to these services. One approach to achieve this, proposed in this short paper, is for CT providers to act as a MaaS provider for older citizens.

The MaaS model for CT would require the CT provider to provide a coordination service which offers journey planning to find transport possibilities and a subscription service for payments to allow older passengers to work with the CT provider to create a package of transport services which best meets their needs. The paper argues that this type of service meets the three established criteria of MaaS: that of mobility on demand, paid by subscription and the opportunity to create new markets.

Further research needs include identifying how much CT clients are willing to pay for the packages identified in Table 1, whether other packages might be better and what the likely take-up would be. This would need to be in the form of a stated choice experimental framework and have both CT clients and older people not using CT at present as respondents. This research needs to be conducted

alongside identifying whether CT organisations can supply services at the price subscribers would be willing to pay. As a business model, MaaS for CT could be one way of ameliorating the lack of equity for this old and frail age group brought about by land use changes in essential services.

References

Alsnih, R., Hensher, D.A. (2006) The mobility and accessibility expectations of seniors in an aging population. *Transp. Res. Part A* 37, 903–916.

Colombo, F. et al (2011), Help Wanted? Providing and Paying for Long-Term Care, OECD Publishing www.oecd.org/health/longtermcare/helpwanted

Denmark, D. and Stevens, N. (2016) Community Transport in Australia, Chapter 15 in Mulley, C., & Nelson, J. D. editors, *Paratransit: Shaping the Flexible Transport Future*. Paratransit: Shaping the Flexible Transport Future (Transport and Sustainability, Volume 8) Emerald Group Publishing Limited.

Donorfio, L. K. M., Mohyde, M., Coughlin, J. & D'Ambrosio, L. (2008) A Qualitative Exploration of Self-Regulation Behaviors Among Older Drivers, *Journal of Aging & Social Policy*, 20:3, 323-339, DOI: 10.1080/08959420802050975.

Haynes, R.M and Bentham, C.G. (1982) The effects of accessibility on general practice consultations, out-patient attendances and in-patient admissions in Norfolk, England. *Social Science and Medicine*, 15, pp 561-556.

Holley-Moore, G. and Creighton, H. (2015) The future of transport in an ageing society. Age UK, London. http://www.ilcuk.org.uk/images/uploads/publication-pdfs/The_Future_of_Transport_in_an_Ageing_Society_FINAL.pdf

Lynott, J. and Figueiredo, C. (2011) How the Travel Patterns of Older Adults Are Changing: Highlights from the 2009 National Household Travel Survey. Fact Sheet 218, April, 2011 AARP Public Policy Institute, 601 E Street, NW, Washington, DC 20049. <http://assets.aarp.org/rgcenter/ppi/liv-com/fs218-transportation.pdf>

Mackett (2014) Overcoming the barriers to access for older people. Centre for Transport Studies, UCL. Contribution to the Transport Working Group of the Age Action Alliance (AAA). <http://ageactionalliance.org/wordpress/wp-content/uploads/2014/11/Overcoming-the-barriers-to-access-Nov-14.pdf>

Musselwhite, C. and Haddad, H. (2010) Exploring older drivers perceptions of driving. *European Journal of Ageing*, 7 (3). pp. 181-188. ISSN 1613-9372.

Rosenbloom, S. (2001) Sustainability and automobility among the elderly: An international assessment, *Transportation*, November 2001, Volume 28, Issue 4, pp 375–408.

Siren, A. K., & Haustein, S. (2012). Cohort analysis of older adults' travel patterns in Denmark. Department of Transport, Bygningstorvet 116B, 2800 Kgs. Lyngby, Denmark ISSN: 1601-9466 (electronic version) ISBN: 978-87-7327-231-2 (electronic version). http://orbit.dtu.dk/files/51308112/note-6_2012_older-adults-travel-patterns_aks.pdf

Whelan, M., Langford, J., Oxley, J., Koppel, S., and Charlton, J. (2006) The Elderly and Mobility: A Review of the Literature, Monash University Accident Research Centre - Report #255 http://www.monash.edu/__data/assets/pdf_file/0017/216530/muarc255.pdf

Wu, Y., Prina, M. Jones, A., Barnes L.E. , Matthews, F.E. , Brayne, C. and MRC CFAS (2016), Land use mix and five-year mortality in later life: Results from the Cognitive Function and Ageing Study, *Health & Place*, 38, pp54-60