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Theme 1: Transport as a means to reach destinations where you meet with other people	



The systematic review was registered in the International pros



### Study characteristics

The characteristics and key findings of included papers are summarised in Table 3. Included papers were published from 1983 up to 2021, including one study examining the relationship between transport and loneliness during the COVID-19 pandemic (Yang and Xiang, 2021). The studies were conducted in over 27 countries across Europe, North America, Asia and Australasia. Across the studies there are data from approximately 188,850 participants, from small qualitative studies with less than a dozen participants up to multi-country studies with more than 100,000 participants. Participants were aged from adolescence through to older age with no studies of children identified. Most studies included male and female participants, with the occasional single-gender study. A broad range of study designs were employed including interview studies and participatory methods, but the most common approach was regression analysis of cross-sectional survey data (either primarily collected, or secondary use of existing datasets).

Papers were identified which examined the relationship between loneliness and the following aspects of travel: private motor vehicles (25 papers), active travel (15 papers), transport infrastructure (12 papers), public transport (10 papers) and community transport (3 papers) (Table 3). Fourteen papers had assessed more than one mode of travel. The majority of studies were observational studies of existing travel behaviours, with only five papers focused on specific transport interventions: Let's Go community mobility programme (Mulry *et al.*, 2020, Mulry *et al.*, 2017, Mulry and Piersol, 2014), subsidised bus passes (Green, Jones and Roberts, 2014, Reinhard *et al.*, 2018) and an extension to a motorway in Glasgow, UK (Nimegeer *et al.*, 2018). Transport was

most often assessed using questions designed for each study, with existing instruments mostly being used to assess constructs like walkability (e.g. Cerin , 2006, Raggi , 2014). The bespoke

Arat and Wong (2017), 6 Middle Income Countries (China, Philippines, Indonesia, Sri Lanka, Thailand, Pakistan), Secondary analysis of data from the cross-sectional Global School-based Health Survey (GSHS)	23,372 adolescents 11-17 years old, part of GSHS (Global School-based Health Survey)	During the past 12 months, how often have you felt lonely? Likert scale of never, rarely, sometimes, most of the time, always	-	-	-	During the past 7 days, on how many days did you walk or ride a bicycle to and from school? Responses dichotomised to Yes (1-7 days) or No (0 days)	-	Walking or cycling to school was correlated with higher odds of loneliness among the respondents from the Philippines, but lower odds of loneliness among respondents from Sri Lanka. The correlation between active transportation and loneliness was not statistically significant in the other included countries. Sociocultural, environmental and climate differences between countries were cited as responsible for the differences in physical activity behaviours.
Avila-Palencia (2018), 7 European cities (Antwerp, Barcelona, London, Orebro, Rome, Vienna, Zurich), Analysis of data from the Physical Activity through Sustainable Transport Approaches (PASTA) cohort study	3,567 participants, median aged 41 yea0 G(y)-IJET479							



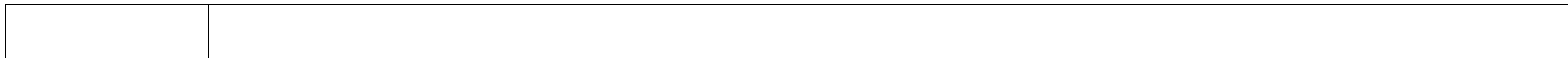




Domenech-Abella (2020b), Belgium, Secondary analysis of cross-sectional data from the Detection, Support and Care for older people Prevention and Empowerment (D-SCOPE) research project	869 participants mean age 75.2 years, standard error 0.27 years, 49.4% female	Social and emotional loneliness measured							
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		Dichotomised to No (Never, Rarely or Sometimes) and Yes (Most of the time or Always)						school to home performed on foot or by bicycle in the last 7 days prior to the survey (in minutes)	
Drennan (2008), Ireland, Cross-sectional survey	683 participants years old (mean 73.5±7.1 years)	Social and Emotional Loneliness Scale for Adults (SELSA-S)	-	-	-	-	-	Access to transport (binary response)	Social loneliness was not found to be associated with access to transport, but those living in rural areas had fewer daily interactions than those in urban areas. Family loneliness was associated with access to transport, and romantic loneliness was not. Good transport facilitates family and social contacts, while the absence of transport can reduce the older person's opportunities for interaction, which can in turn contribute to loneliness.
Franke (2020), Canada, Photovoice study	13 rural living participants aged 85% female	Qualitative - emergent theme from the analysis	-	-	-	-	-	Qualitative - emergent theme from the analysis	Activities that allow participants to "share thoughts and life experiences" help to reduce feelings of loneliness and build enthusiasm. Such activities help to counter effects of declining independence (e.g. being housebound, having to give up driver's license). Participants with mobility aids stressed that mobility aids help to increase social connectedness by making connections more accessible. Participants saw transportation as a gateway to expose them to the community.





Johnson (1995), USA, Interview study	75 participants, mean age of 83.6 years, 60% female	Qualitative - emergent theme from the analysis	All participants had made the decision to stop driving within 2 years of				options included always or almost always, sometimes, or not often.	





Mulry and Piersol (2014), USA, Uncontrolled pre-post mixed methods evaluation of the Let's Go programme	7 participants old, 57% female	Impact on Autonomy and Participation Questionnaire						
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Reinhard (2018), England, Analysis of data from seven waves of the English Longitudinal Study of Ageing (ELSA)	18,453 participants age and their partners	UCLA Loneliness Scale 3-item	-	-	User of transport or not as working of question changes between survey sweeps.	-	-	Transport use was associated with less loneliness, and an increase in volunteering at least monthly. Eligibility for free bus travel was associated with increased odds of using public transport. Transport use was associated with increased face-to-face contact with children and friends, but less contact with other family members.
Smith (2012a), USA, Interview study	12 community-dwelling older adults (>70 years old, not depressed) who had experienced loneliness in the previous 6 months	UCLA Loneliness Scale and pre-defined interview topic	Qualitative - emergent theme from the analysis of the transcripts	-	-	-	-	Loss of transportation interfered with participants' ability to get out and connect with others.
Smith (2012b), USA, Interview study	12 participants between the ages of 74 and 98 years of age who had experienced loneliness in the previous 6 months, 67% female	UCLA Loneliness Scale, Version 3 plus loneliness coping interview	'Giving up the car' was a major theme in relation to the loneliness experience	-	-	-	-	Many

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									wellbeing. Driving was not seen as a social activity.
Weijs-Perrée (2015), Netherlands, Path analysis of a cross-sectional survey	177 participants, 46% aged <40 years, 49% aged 40-65 years and 35% aged >65 years, 62% female	UCLA Loneliness scale 3-item	Number of cars per household	-	-	-	Frequency of walking or cycling	-	Car ownership was associated with reduced feelings of loneliness. Frequency of walking was associated with higher social satisfaction and frequency of cycling was associated with higher number of social interactions.
Windle (2004), Wales, Survey and interview study	423 participants, mean age 78 years. 58.9% female	Qualitative - emergent theme from the analysis	Survey questions on transportation and transport difficulties	-	-	Survey questions on transportation and transport difficulties	-	-	Those without access to a car and who also did not use the bus reported significantly higher levels of loneliness than the rest of the respondents. Declining health contributed to the decision to give up the car and limited their use of public transport.
Wormald, McCallion and McCarron (2019), Ireland, Cross-sectional analysis of data from TILDA cohort	708 adults with intellectual disability, mean age 56.2 years (95% confidence interval 55.2-57.1), 59.3% female.	UCLA Loneliness scale 3-item and an item which asked whether the participant labelled themselves as lonely	-	-	-	-	-	A variable indicating whether the participants experienced transport difficulties, no further details provided.	Older people with learning disabilities who have no functional limitation tend to lead more independent but experiencing transport difficulties increase their feelings of loneliness.
Yang and Xiang (2021), USA, Surveys conducted during the COVID-19 pandemic	2,667 participants, 54.6% aged 18-34 years, 38.0% aged 35-59 years and 7.4% aged female	UCLA Loneliness scale 3-							

Clear  
aims

Qualitative  
methods

Reinhard (2018)

Yes

Yes

### Quality assessment

As a result of the study designs used in the included papers, the following three tools were used to quality appraise the included papers: the CASP checklist for qualitative studies, the CASP checklist for cohort studies and the Centre for Evidence Based Medicine checklist for surveys. Each of these checklists asks you to assess whether the paper does or does not report against each criterion, or whether you cannot tell. To s



In the absence of a car, public and community transport (including subsidised bus passes) become more important, with several studies documenting reduced feelings of loneliness among older people who more regularly use public transport (Franke, 2020, Hagan, 2019, Matsuda, 2019, Reinhard, 2018, van den Berg, 2016, Windle, 2004). Similarly, when there was inadequate public or community transport, studies documented greater feelings of loneliness (Matsuda, 2019, Rajé, 2003, Stanley, 2010, Wormald, McCallion and McCarron, 2019). However, Donoghue, McGarrigle and Kenny (2019) found that the men among their sample of older people who used public transport reported more feelings of loneliness than women. This may reflect the change in status from driving independently to being dependent on public transport.

There was less discussion of active modes of travel for getting to places to meet people to address loneliness. This might suggest that the purpose of travel in these studies was to meet with people who you already know, such as seeing family or meeting up with friends who may live further away than can be accessed through active means (Drennan, 2008). Nimegeer (2018) identified that a motorway extension reduced loneliness for those who now had better routes to

community mobility programme was designed to address loneliness among older people with mental health difficulties, and later piloted with a broader age range of adults with mental ill-health (Mulry, 2020, Mulry, 2017, Mulry and Piersol, 2014). The programme was found to improve participants sense of autonomy through increasing their knowledge and confidence in relation to local transport options. These changes were not found to have an impact on sense of loneliness within the study timeframe. However, this programme demonstrates the potential for interventions to support those who cease driving in older age.

Twelve papers discussed modes of travel as spaces in which you meet other people, including a number of studies related to cycling and walking. Public transport was particularly noted as a space where you can meet other people.

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Green, Jones and Roberts (2014, p.480)  
Reinhard (2018) noted that public transport use was associated with increased face-to-face contact with children and friends, but less contact with other family members. Secondary school students in a study in New Zealand reported that traveling on the bus was a social activity, whereas driving was a lonely activity (Ward, Freeman and McGee, 2015). One participant in a study from #, reflecting a belief that cars were spaces disconnecting those inside from the world around them (Nixon, 2014). Nixon (2014) reported a communication asymmetry between road users. Cyclists, pedestrians and those on the bus could communicate with each other in a way that drivers could not, which 50% of drivers spoke about as making them feel lonely; observing but not participating in the world around them. Avila-Palencia (2018) found that cycling was associated with reduced feelings of loneliness, noting that pedestrians and cyclists met more people and felt greater social cohesion. Four other studies noted an association between social network size and use of public transport or active travel (Chen, While and Hicks, 2014, Tsunoda, 2015, van den Berg, 2016, Weijts-Perrée, 2015). These are mostly cross-sectional studies and therefore we cannot be sure whether people with large social networks have more opportunities to travel, or whether the journeys themselves provide more opportunities to connect with other people.

There appear to be socio-cultural differences between countries in relation to whether public transport and active5.32 8t



Over . . . . . Hall and Merolla (2020). The idea of the social biome is that we need a mix of social contacts in our lives, not just deep trusted friendships which will might travel long distances for, but also casual and opportunistic encounters, like those in the street or on the bus. By using the term biome, Hall and Merolla (2020) relate our social lives to biological systems or ecosystems, and the findings of this systematic review suggest that societies need a system of mixed transport options to avoid people feeling lonely.

1. Interventions are needed to support people in phases of life when driving is not an option, such as older age and single parents. Even when transport options are available, these groups may need support accessing them such as bus passes, low-level buses or easy to read timetables.
2. Public and community transport, and active travel routes need to support people reaching friends and family, not just places of work or retail.
3. Some people value opportunities to connect while travelling, while other appreciate the time to disconnect. Modes of travel and transport policy should consider both of these desires.
4. Transport policy and interventions should consider all road users not just drivers, with the assessment of loneliness or social connections providing valuable insights into the effects of these interventions.

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