

FINAL REPORT

**SEGMENT: Applicability of an Existing
Segmentation Technique to TDM Social Marketing
Campaigns in the United States**

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SEGMENT: APPLICABILITY OF AN EXISTING SEGMENTATION TECHNIQUE TO TDM SOCIAL MARKETING CAMPAIGNS IN THE UNITED STATES

Final Report

NITC-RR-1057

by

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EXECUTIVE SUMMARY

Social marketing seeks to develop and integrate marketing concepts with other approaches to influence behaviors that benefit individuals and communities for the greater social good (International Social Marketing Association, 2013). Social marketing is a useful transportation demand management (TDM) planning approach to promote travel-behavior change, and combines at least seven distinguishing features which set it apart from other popular, behavior-change planning approaches, such as education and mass media campaigns. These seven features include a focus on socially beneficial behavior change; a strong consumer orientation; the use of audience segmentation techniques and the selection of target audiences; the use of marketing's conceptual framework (marketing mix and exchange theory); the recognition of competition; and continual marketing research.

The purpose of this study was to explore a consumer market segmentation technique (SEGMENT) successfully used in Europe for its applicability to social marketing campaigns in the United States.

The SEGMENT project in Europe was a three-year project that examined how consumer market-segmentation techniques can influence travel-behavior choices in favor of more energy-sustainable modes of travel. The project analyzed over 10,000 responses to comprehensive attitudinal surveys containing over 100 questions to generate eight main attitudinal segments useful for the design of mobility social marketing campaigns; additional analysis produced 18 “golden questions” representing the smallest number of survey questions required to reproduce the eight market segments (Intelligent Energy Europe, 2015).

The SEGMENT project in Europe concluded that most of their eight segments can be detected in all locations (27 EU member states); however, the proportion to which each segment is represented in each partner city differs. Additionally, the SEGMENT project analysis identified key dimensions of diversity across attitudinal groups which enabled a core set of attitudinal questions to be identified; from these different dimensions, the golden questions were produced.

The eight segments and golden questions identified by the European SEGMENT project cannot be directly transferrable to the United States' population without further analysis. The research questions for this study included:

- Are attitudinal market segments the same in Europe and the United States?
- What proportion of each segment is represented in each of three states in the United States?
- Are the golden questions used in Europe able to accurately predict segment orientation in the United States?

Major contributions of this project are the validation of a successful existing segmentation technique for applicability in the United States, which will maximize the impact of TDM social marketing campaigns on changing travel behavior and reduce the costs of customized segmentation studies.

1.0 LITERATURE REVIEW

1.1 SOCIAL MARKETING

According to the International Social Marketing Association, *social marketing* is a practice that “seeks to develop and integrate marketing concepts with other approaches to influence behaviors that benefit individuals and communities for the greater social good.” Furthermore, the “practice is guided by ethical principles. It seeks to integrate research, best practice, theory, audience and partnership insight, to inform the delivery of competition sensitive and segmented social change programs that are effective, efficient, equitable, and sustainable.” (International Social Marketing Association, 2013). The National Social Marketing Centre (NSMC) of England (2011) defines social marketing as “an approach used to develop activities aimed at changing or maintaining people’s behavior for the benefit of individuals and society as a whole.” Another definition that further explains the practice is “Social marketing is a process that applies marketing principles and techniques to create, communicate, and deliver value in order to influence target audience behaviors that benefit society (public health, safety, the environment, and communities) as well as the target audience” (Lee and Kotler, 2011).

Whereas traditional marketing is used to sell goods and services, social marketing sells behaviors. Social marketers typically want to influence target markets to do one of four things: (1) accept a new behavior (e.g., bicycle to work); (2) reject a potentially undesirable behavior (e.g., purchase a vehicle); (3) modify a current behavior (e.g., decrease number of single occupancy vehicle trips); or (4) abandon an old undesirable behavior (e.g., texting while driving). Social marketers may also encourage a one-time behavior (e.g., purchase a fuel-efficient vehicle) or the establishment of a habit and the prompting of a repeated behavior (e.g., wearing a seat belt) (Lee and Kotler, 2011). Additionally, the behavior change must benefit society; “social marketers insist that the behaviors being promoted contribute to the consumers’ and society’s well-being... social marketers see it as their responsibility to design and deliver offerings that preserve and enhance social good” (Bryant, 2000). The key goal of social marketing in contrast with commercial marketing is outlined as, “. . . commercial marketing tries to change people's behavior for the benefit of the marketer; social marketing tries to change people's behavior for the benefit of the consumer, or of society as a whole,” (Lawrence, 2015).

1.1.1 Examples of Social Marketing Campaigns

Social marketing has been applied in many different fields including public health (e.g., tobacco use), environmental protection (e.g., recycling), and injury prevention (e.g., seat belt use).

Two examples of social marketing campaigns that are somewhat familiar and have had impactful results will be discussed in the next section: a) the 30-years old and continuing anti-littering campaign, “Don’t mess with Texas: Keeping Texas Litter Free,” and b) the anti-tobacco use campaign “truth®.”

1.1.1.1 The Anti-littering Campaign, “Don’t mess with Texas”

“Don’t mess with Texas” was a collaborative among the Texas Highway Commission, the Texas Department of Transportation (TxDOT) Adopt-A-Highway litter prevention programs, and Keep Texas Beautiful that conducts an annual Trash-Off day.

The campaign included advertising by well-known Texas celebrities and the placement of “Don’t mess with Texas” trashcans that were made available to businesses and entertainment venues. More recently, celebrities posted anti-litter selfies on their social networks with the red, white, and blue barrels made recognizable by the campaign. The Texas example illustrates a definition of social marketing as, “. . . a proven, evidence-based approach that combines behavioral science and design methodologies to motivate your audience to take action,” (Weinreich Communications, 2016).



Figure 1.1: Don't mess with Texas advertisement

While researching the target market, it was discovered that 18- to 35-year-old males were most likely to litter. The behavior was unintentional, and this market group did not recognize that their littering was contributing to the problem. This market segment was found to have a high degree of Texas pride, preferred pickup trucks, loved football, and listened to music while driving. The resulting TV and radio commercials featured celebrity Texans playing music that this group identified with.

One measurable impact of the campaign was the reduction in cost of cleaning the roadways from \$2.33 to only \$1.90 per Texan (Smith, 2016).

1.1.1.2 The truth[®] Campaign

When targeting youth (ages 12 to 17 years old) in the United States for tobacco use prevention from 1999 to 2002, smoking decreased from 25.3% to 18% (300,000 young people), with the American Legacy Truth truth[®] campaign credited for 22% of that reduction (Farrelly et al., 2002).



Figure 1.2: truth[®] campaign advertisement

Several effective strategies were used in the campaign. The truth[®] campaign set to reach the younger population by positioning their brand to compete with the tobacco brands (Allen, 2010). The advertising strategy was based on revealing that cigarette manufacturers intentionally lied about what they knew to be cancer-causing elements in their products. The teens were encouraged to rebel against the industry. The campaign focused on altering the core beliefs and attitudes against smoking, swaying the intention to smoke, and decreasing the frequency of smoking.

Among the many studies that evaluated the truth® campaign, one attributed the increase in anti-tobacco attitudes and beliefs to the counter marketing advertisements (Weinreich, 2016). Another study concluded that using behavioral branding works well as a public health strategy (Evans, 2005).

1.1.2 Distinguishing Features of Social Marketing

Social marketing integrates several distinguishing features, which set it apart from other popular behavior-change planning approaches, such as education and mass media campaigns. These features include:

- a focus on socially beneficial behavior change;
- a strong consumer orientation;
- the use of audience segmentation techniques and the selection of target audiences;
- the use of marketing's conceptual framework (marketing mix and exchange theory);
- the recognition of competition; and
- continual marketing research.

Of particular relevance to influencing behavior effectively is the need to segment an audience and target measures accordingly (Davies, 2012). Segmentation refers to dividing a market into groups of customers to develop different products, services, and communications to meet their specific needs, and to focus resources on those segments that have the greatest potential for change. Segmentation can increase the efficiency and effectiveness of social marketing efforts (Andreasen, 2002; Kotler and Lee, 2008; McLeay and Oglethorpe, 2013), and several studies have shown that not only do distinct market segments exist within social contexts, but they have differential responses to social marketing programs (Gray and Bean, 2011; Schuster, Kubacki, and Rundle-Thiele, 2015; Walsh et al., 2010).

1.2 MARKET SEGMENTATION

Market segmentation approaches prioritize groups of consumers based on similarities such as demographic, geographical, behavioral, and psychographic characteristics. Figure 1.3 depicts the various characteristics that may be used to segment audiences. For example, groups may be segmented based on a behavioral trait such as their readiness to change stage: *“I’ve been trying to use my seat belt, but I just keep forgetting”* versus *“I am never going to use that darn thing, it’s a nuisance.”* Often a segment will be based on a combination of these factors.

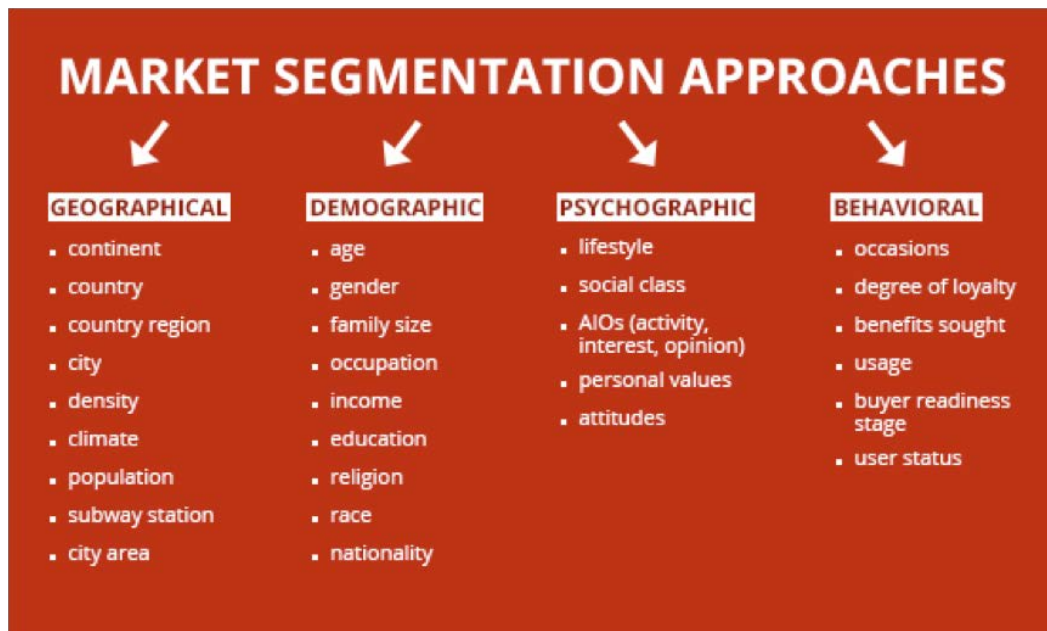


Figure 1.3: Market segmentation approaches

Branded segmentation techniques include Values, Attitudes, Life Style (VALS™), and Potential Rating Index by ZIP market (PRIZM®).

1.2.1 Values, Attitudes, Life Style (VALS™)


VALS™ segments U.S. adults into eight distinct groups using a specific set of psychological traits and key demographics that drive consumer behavior (Strategic Business Insights, 2009-2017). Based on their responses to questions in the VALS™ Survey, individuals are assigned to one of the eight segments which include innovators, thinkers, achievers, experiencers, believers, strivers, makers, and survivors, as depicted in Figure 1.4. The eight segments are further organized by their resources (high and low), and which values drive them (ideals, achievement, and self-expression).



Figure 1.4: U.S. VALS™ framework

Figure 1.5 depicts representative sample demographics and behaviors for the eight segments, and Figure 1.6 shows a sample of characteristics that make each VALS™ group unique.

Demographic and Behavior Snapshots Highlight the Vibrancy of Using VALS™



Primary Motivation	Ideals			Achievement		Self-Expression		
	Innovators	Thinkers	Believers	Achievers	Strivers	Experiencers	Makers	Survivors
Psychological Descriptors	Lifestyle Changers Information Ready Future Oriented	Conservative Mature Reflective	Economical Neighborhood Me-Too Followers	Aspirational Hardworking Moderate	Fun Loving Up to Date Overwhelmed	Assertive Energetic Optimistic	Hands-On Practical Self-Reliant	Cautious Loyal Traditional
Median age	40	60	51	38	30	24	47	68
Median HHI	\$118K	\$107K	\$55K	\$104K	\$33K	\$70K	\$55K	\$24K
	Percent of Innovators	Percent of Thinkers	Percent of Believers	Percent of Achievers	Percent of Strivers	Percent of Experiencers	Percent of Makers	Percent of Survivors
Women	44	51	80	52	44	45	27	60
Married	48	77	59	85	27	21	72	37
Employed full-time	64	47	48	74	40	48	60	12
Live with a parent	14	2	7	7	25	48	7	3
Took a foreign trip in the past 3 years	51	40	17	30	14	23	17	10
Own a smartphone and a tablet	47	41	32	51	26	38	25	7
Own an internet video device for TV	32	19	10	23	9	18	11	4
Buy "green" paper products	22	19	19	12	20	2	19	23
Prayer is a part of my daily life	15	40	49	34	27	35	36	51

Source: VALS™/GfK MRI, Spring 2015

Figure 1.5: Demographic and behavior snapshots highlights the vibrancy on using VALS™

Characteristic Snapshots Emphasize Important Differences by VALS™

Ideals			Achievement		Self-Expression		
Innovators	Thinkers	Believers	Achievers	Strivers	Experiencers	Makers	Survivors
Are confident enough to experiment	Plan, research, consider before acting	Believe in right/wrong for a good life	Have a me-first, my-family-first attitude	Are the center of street culture	Go against the current mainstream	Are distrustful of government	Are cautious and risk averse
Are information ready	Are the old guard	Want friendly communities	Are fully scheduled	Live in the moment	Want everything	Believe in sharp gender roles	Are oldest
Are future oriented	Enjoy historical perspective	Not looking to change society	Are peer conscious	Wear their wealth	Are spontaneous	Protect what they think they own	Spend most of their time alone
Are receptive to new ideas and technologies	Have "ought" and "should" benchmarks for social conduct	Have no tolerance for ambiguity	Are anchors of the status quo	Desire to better their lives; have difficulty in doing so	Have a heightened sense of visual stimulation	Have strong mechanical and automotive interests	Take comfort in routine and the familiar
Enjoy problem-solving challenges	Use technology in functional ways	Have strong me-too fashion attitudes	Believe money is the source of authority	Experience revolving employment	Introduce new sayings	Have strong outdoor interests	Are loyal to brands and products
Are self-directed consumers	Are not influenced by what's hot	Watch TV; read romance novels	Are committed to family and job	Are fun loving	See themselves as very sociable	Are not concerned with being fashionable	Are least likely to use the internet
Are skeptical about advertising	Follow traditional intellectual pursuits	Find advertising a legitimate information source	Value tech that provides a productivity boost	Use video and video games as a form of fantasy	Are first in, first out of trend adoption	May be perceived as anti-intellectual	Are heavy TV viewers

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Figure 1.6: Characteristic snapshots emphasize important differences by VALS™

1.2.2 Potential Rating Index by ZIP market (PRIZM®)

Often viewed as the leading segmentation tool, Nielson-Claritas' PRIZM® combines demographic, consumer behavior, and geographic data to target customers. PRIZM® was developed assuming that similar households group naturally by geography. Using census data, PRIZM® groups U.S. households into 66 demographically and behaviorally distinct segments, (*Nielson PRIZM®*). Figure 1.7 lists the 66 segments grouped in 14 social groups with brief definitions in Table 1.1. Figure 1.8 lists the 66 segments grouped in 12 life stage classes with brief definitions in Table 1.2.



Figure 1.7: PRIZM® Social Groups

Source: PRIZM® and its segmentation explanations and graphics are © 2013 The Nielsen Company. Illustrations by Scott Brooks, <http://www.srds.com/frontMatter/ips/lifestyle/reports/PRIZM®.html#social>

Table 1.1: Characteristics of Households

Urban	Suburban	Second City	Town & Rural
<i>High density population centers in major metropolitan areas</i>	<i>Moderately dense neighborhoods surrounding the Urban or Second City core</i>	<i>Moderately dense population centers of smaller cities and larger towns</i>	<i>Small town and rural areas, as well as low density suburbs on the exurban fringe</i>
<p>Urban (U) Social Groups have population density centiles mostly between 85 and 99. They include both the downtown areas of major cities and surrounding neighborhoods.</p> <p>Households in this classification live within the classic high density neighborhoods found in the heart of America's largest cities. While almost always anchored by the downtown central business district, these areas often extend beyond city limits and into surrounding jurisdictions to encompass most of America's earliest suburban expansions.</p>	<p>Suburbs (S) have population density centiles between 40 and 90 and are clearly dependent on urban areas or second cities.</p> <p>Unlike Second Cities, they are not the population center of their surrounding community, but rather a continuation of the density decline as you move out from the city center.</p> <p>While some Suburbs may be employment centers, their lifestyles and commuting patterns will be more tied to Urban or Second City cores.</p>	<p>Second Cities (C) are less densely populated than urban areas with population density percentiles typically between 40 and 85.</p> <p>While similar to suburban population densities, Second Cities are the population center of their surrounding community. As such, many are concentrated within America's smaller cities and larger towns.</p> <p>This class also includes satellite cities or higher density suburbs encircling major metropolitan centers, typically with far greater affluence than their small city cousins.</p>	<p>Town & Rural (T) Social Groups have population density centiles under 40. This Social Group includes exurbs, towns, farming communities and a wide range of other rural areas.</p> <p>The town aspect of this class covers the thousands of small towns and villages scattered among the rural heartland, as well as the low-density areas far beyond the outer beltways and suburban rings of America's major metros. Households in these exurban segments live among higher densities and are more affluent than their rural neighbors are.</p>

Source: PRIZM® and its segmentation explanations and graphics are © 2013 The Nielsen Company. Illustrations by Scott Brooks, <http://www.srds.com/frontMatter/ips/lifestyle/reports/prizm.html#social>



Figure 1.8: PRIZM® Lifestage Group

Source: PRIZM® and its segmentation explanations and graphics are © 2013 The Nielsen Company. Illustrations by Scott Brooks, <http://www.srds.com/frontMatter/ips/lifestyle/reports/prizm.html#social>

Table 1.2: Characteristics of Life Stage Groups

Younger Years	Family Life	Mature Years
<i>Predominantly under age 45, singles and couples mostly without children</i>	<i>Predominantly middle-aged families with children in the household</i>	<i>Predominantly age 55 and above, empty-nest couples and mature singles</i>
<p>Segments in Younger Years (Y) consist of mostly singles and couples who are typically under 45 years old and generally have no children in the household. Residents may be too young to have children and/or are approaching middle age and choose not to have them.</p> <p>At the household level, around age 45 is the cutoff for most segments. Among these younger segments, only those explicit in their definition for lack of children or with low indices for presence of children, tend to be included in Younger Years.</p>	<p>Family Life (F) is composed of segments that are middle-aged and either defined by presence of children in the household or have high indices for households with children under age 18. They may be married couples or single parents.</p> <p>At the household level, presence of children is the primary driver for many segments in this class. While this class also includes segments where the presence of children is not explicit at the household level, in general they do show high indices for that characteristic.</p>	<p>Mature Years (M) includes segments whose residents are primarily empty nesters or those with children in their late teens, away at college, or rebounding back to mom and dad's home.</p> <p>At the household level, the primary driver is age, not necessarily the absence of children. Segments that are uniquely child-centered tend to be younger and are grouped under Family Years while those under age 45 and without children are grouped in Younger Years—leaving the last group of segments for the Mature Years.</p>

Source: PRIZM® and its segmentation explanations and graphics are © 2013 The Nielsen Company. Illustrations by Scott Brooks, <http://www.srds.com/frontMatter/ips/lifestyle/reports/prizm.html#social>

1.2.3 Examples of Transportation Market Segmentation

Several transportation organizations have used segmentation approaches to differentiate groups of users based on their personal travel behaviors and characteristics.

1.2.3.1 Cycling Behavior

According to Roger Geller, the Bicycle Coordinator at the Portland Bureau of Transportation (2006), the following are categories that describe Portlanders and their relationships to bicycling:

- The “Strong and the Fearless” bicycled in Portland regardless of roadway conditions.

- The “Enthusied and Confident” were those comfortable sharing the roadway with auto traffic; however, they appreciated bicycle lanes and bicycle boulevards.
- The “Interested but Concerned” were those who are interested but had concerns about safety on the traffic network.
- The “No Way, No How” group were just not interested in bicycling.

Geller divided Portlanders into these groups to better understand the recipients of bikeway treatments. A further investigation of these market segments offered better understanding of the demographics of each as well as attitudes and perceptions to the physical environment and to social and personal factors (Dill and McNiel, 2013).

1.2.3.2 Mode Choice Behavior

In order to assess mode choice, eight market segments in the European Segment project were identified based on distinct psychographic groups (Anable, 2013). Segmentation was achieved based on behaviors and reactions to marketing messages and specific transportation initiatives. The eight market segments were:

- “Devoted Drivers” were not convinced that other modes are realistic alternatives and therefore primarily used their cars for travel.
- “Image Improvers” did not want any restrictions on driving, nonetheless somewhat concerned for the environment.
- “Malcontented Motorists” found driving stressful and desired the reduction of car use, but found the alternatives not practical for their travel needs.
- “Active Aspirers” were motivated by environmental awareness, and prefer walking and cycling to public transportation in short trips when trying to reduce car use.
- “Practical Travelers” used cars for efficiency and practicality and had little tendency to change their habits.
- “Car Contemplators” aspired to be car owners, desiring the freedom and independence driving offers.
- “Public Transport Dependents” were not anti-car mode, had little interest in environmental issues, and were frustrated with transit service.
- “Car-free Choosers” were conscientiously using healthy modes of transportation and deeply concerned about environmental issues.

The research by Anable confirmed that in-depth segmentation in travel behavior could be effectively used in developing transportation policies.

1.2.3.3 Public Transportation

In addition to on-time performance, basic concerns of transit agencies are maintaining ridership numbers and attracting new riders to public transportation. New transit services (e.g., wi-fi on buses/trains or trip planning) have been implemented in many agencies to promote transit use to new riders and improve customer satisfaction. If the current or potential transit rider is not a user of these technologies, promoting these services does not affect their choices. Understanding the rider has been very important in planning and managing transit.

The 1998 Transit Cooperative Research Program (TCRP) Reports 36 and 37, published as handbooks, discussed and evaluated the use of market research by the transit industry (Elmore-Yalch, 1998). In these handbooks, segmentation techniques suggested to the transit market, in addition to surveys, were PRIZM® and VALS™. The handbook suggests selectively appealing to each of the following groups:

- Riders versus nonriders, frequent riders versus infrequent riders versus occasional riders, or former riders versus current riders.
- Loyal riders versus vulnerable or nonloyal riders.
- Transit dependent riders versus choice riders.
- Commuters versus noncommuters.
- Residents of high-density areas versus suburban residents.
- Commuters to downtown CBDs versus suburb-to-suburb commuters.
- Student commuters versus work commuters.
- “High” versus “mid” versus “low” income groups.
- Geographic location as defined by ZIP code, census tract, or transit analysis zone.

Recent research by van Lierop and El-Geneidy (2017) used information from five years of satisfaction surveys to understand the different groups who take transit. Their research uncovered nine market segments present across different modes in two Canadian transit agencies: service-driven riders; economizing riders; convenience riders; weekend riders; occasional weekday riders; frustrated riders; disloyal riders; young riders; and carless riders. Additionally, three overarching groups of transit users based on income and vehicle access emerged:

- Choice users (representing approximately 69%): Car access
- Captive users (approximately 18%): No car access, low income
- Captive-by-choice users (approximately 13%): No car access, do not have low income

Van Lierop and El-Geneidy conclude that the identification of three different transit segments is beneficial “to develop policy recommendations that reach further than policies directed at a single cluster.” Additionally, improvements targeted at a single segment could improve the experiences of other groups of riders as well, thus motivating ridership among different users.

1.3 TRANSPORTATION DEMAND MANAGEMENT

As illustrated in Figure 1.9, transportation demand management (TDM) includes different strategies that aim at providing different travel options to commuters to reduce (or eliminate) car use, particularly the single-occupancy vehicle mode. Using public transit, vanpooling or carpooling reduces the harmful emissions and saves travel costs for riders. Non-motorized modes such as bicycling and walking serve to save money and decrease travel costs while also promoting a healthier lifestyle. Telework eliminates the trip and any environmental impacts associated with it while providing convenience to the worker.

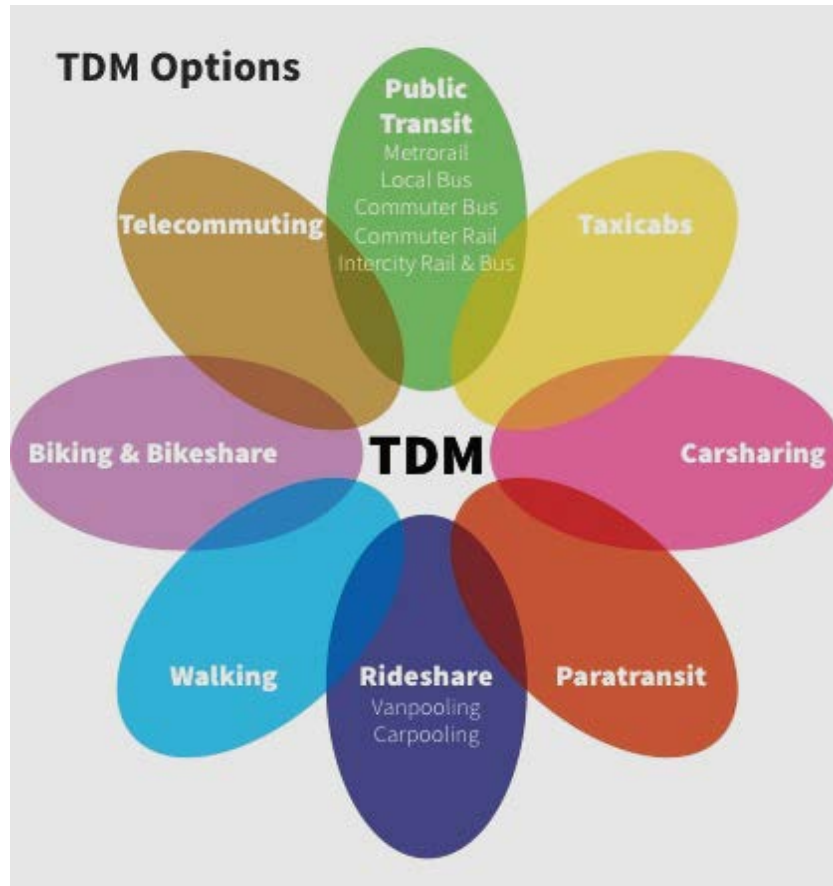


Figure 1.9: Transportation demand management

Several policies and strategies have been used to encourage the use of other travel options (or eliminate travel by teleworking) while reducing single-occupancy vehicle (SOV) trips and miles traveled. Tax reform in the early 1990s gave employers a small tax break as an incentive to provide their employees with public transportation costs or subsidies as a pre-tax benefit. Other techniques included pricing that curbs driving at peak hours (e.g., London Congestion Charge, U.K., and 95 Express managed lanes between Miami and Ft. Lauderdale, FL). In addition, marketing campaigns have been used to increase awareness of how driving affects the environment, examples illustrated in Figure 1.10.



Figure 1.10: Marketing and Services that Encourage non-SOV Options

1.4 SOCIAL MARKETING AND PERSONAL TRAVEL BEHAVIOR

Additionally, several programs have utilized a community-based social marketing approach to influence personal travel behavior. Following is a description of several programs that have used this approach to encourage neighborhood residents to use more sustainable methods of transportation such as walking, bicycling, transit and carpooling rather than single-occupant vehicle trips.

1.4.1 Travel Blending®

Travel Blending® is an approach of personalized travel planning that includes analyzing current travel behavior, providing suggestions on modifying travel, and monitoring with feedback to achieve blending travel choices over time (Rose and Ampt, 1997; Ampt and Rooney, 1999). The program suggests thinking about the order of the trips (trip chaining); blending modes (i.e., sometimes car, sometimes walk, sometimes public transport etc.); blending activities (i.e., doing as many things as possible in the same place or on the same journey); or finally blending over time (i.e., making small sustainable changes over time on a weekly or fortnightly basis).

1.4.1.1 Individualized Marketing (IndiMark®) in TDM

Individualized marketing (IndiMark®) was first developed and implemented in South Perth, Australia, in 1997, and has since been implemented in many other countries around the world with the goal of reduced car traffic and increased use of public transport, walking and cycling. The IndiMark® technique is comprised of five steps: (1) contact phase; (2) segmentation phase; (3) confirmation phase; (4) information and motivation phase; and (5) convincing phase. In the contact phase, households within a predefined geographic region are contacted by phone, with a

goal of direct contact with every member of the target population. The target population serves as the intervention group while a completely separate group acts as the control group. This differentiates IndiMark® from Travel Blending®, as IndiMark® considers all contacted households as exposed to the intervention, regardless if they participate in the program; in doing so, the reporting of behavior change represents whole communities. During the segmentation phase, households are segmented into several broad categories in order to determine the type of treatment they receive: regular user (“R”) of environmentally friendly mode, interested (“I”) in using environmentally friendly mode, and not interested (“N”) in using environmentally friendly mode. Households identified as not interested receive no further contact. Households identified as regular users move to the confirmation phase, which rewards households with at least one member who regularly walks, bikes, or uses public transport with a small gift. Households identified as interested move to the information and motivation phase, which provides an opportunity for residents to order information and services (e.g., generic information brochures, personalized documents, test tickets for the public transport network), and provides them with support and encouragement (verbal support, advice and comments). Finally, further services for walking, cycling and public transport are offered through home visits during the convincing phase.

The program evaluation is based primarily on before-and-after mail travel surveys of the intervention and control households, which asked respondents about activities during the day prior. Additionally, analysis of public transport electronic ticketing information on services operating in the area subject to the intervention is conducted. The IndiMark® large-scale demonstration project in South Perth (1997) decreased car trips by 14%, increased walking by 35%, increased cycling by 61%, and increased public transport by 17%. Additionally, the average reduction in individual car trips across the target populations of all IndiMark® programs (i.e., South Perth and Brisbane, Australia; Portland, U.S.; Goteburg, Sweden; Gloucester, UK; etc.) conducted between 1997 and 2002 was about 10%, with a range of 6% to 14% for specific interventions, which equates to a 5.5% to 13% reduction across the entire population (Roth et al., 2003).

1.4.1.2 TravelSmart Australia

The TravelSmart Household Program (TSHP) is a component of Australia’s larger TravelSmart program following the successful application of individualized marketing (IndiMark®) in South Perth in 2000. The TravelSmart program encourages and supports residents at the household level to voluntarily change their travel behavior from car use to more environmentally friendly ways of traveling by motivating and providing personalized information on public transport, walking and bicycling. The specific aims of the project are to reduce private car use through behavior change, measured by vehicle kilometers travelled (VKT); achieve ongoing change in travel behavior; engage individuals on a voluntary basis; directly engage people within their own settings and cultural context, capturing interest across all social-demographics; provide simple, motivation tools and techniques addressing individuals’ most significant barriers to behavior change; build strong partnerships with key stakeholder; integrate continuous improvement into project delivery; and independently measure behavior change results using statistically valid methods.

For each implementation of this program (Inner North, West Torrens, West), a large, geographically diverse area is selected to serve as the target market. The most current version of

the project is the TSHP in the West, which is described in this section. Prior to project delivery, a study of community perceptions about private car use and more sustainable travel options was undertaken to identify perceived barriers and benefits of reducing car use and making alternative choices such as public transport, walking, and cycling. For example, the project in the West identified benefits such as money, petrol reduction, environment, and health/physical activity, and barriers such as time, work commitments, inconvenience, and lack of connectivity. These findings influence the design of the project and the supporting tools, which enable a more strategic approach targeting the specific concerns of the community.

Residents in the target area are then approached via two components delivered concurrently: a community development approach, and an individualized conversation-based approach using the IndiMark® technique. For the community development approach, community organizations such as clubs, churches, schools, and workplaces are targeted and asked to host a TravelSmart presentation for their members. For the individualized conversation-based approach, households receive a mailed letter introducing them to the program and letting them know they would be contacted soon, as well as giving credibility to the TravelSmart staff who would be contacting them. Households are then contacted by phone or in person and engaged in a guided conversation aided by tools to help them make changes that appealed to them and consistent with their values or motivations. Tools of change include a local activities guide, access guide (map), affirmation letter, kid's activities, journey planner, promotional postcards, ideas letter, good newsletter, kilometer monitor, shopping list, memory jogger, travel blending diary, and work-from-home information.

TravelSmart Household Project evaluation is based on the use of two measurements: global positioning system (GPS) surveys and vehicle odometer surveys. The primary objectives of the evaluation are to provide data to measure changes in household travel behavior, focusing on travel by private car, and to understand the factors (barriers and benefits) that contribute to travel-behavior choices. The project used longitudinal panels carried out prior to household engagement until after the conclusion of project delivery to collect repeated sets of measurements ("waves"); each wave involved continuous monitoring of all households in the panel for a one-week time period. The panels included participants and non-participants representing test and control groups; the non-participants were chosen at random to be representative of the target area's population. The GPS survey required all household members to carry a personal passive GPS data logger for one week annually (three waves total), and collected mode of transport, number of trips made, trip duration and distance travelled. The odometer survey required each household to report the odometer readings from all the vehicles they owned every four months (eight waves total).

At the completion of the project, the TSHP in the West reported a reduction of 10.4 kilometers per household per day, representing an 18% reduction. Additionally, the total reduction of VKT per day for all participating households was 229,850 kilometers per day while non-participants increased VKT by 605,030 kilometers.

Finally, a community perceptions survey was undertaken at the completion of the project using the same respondents and survey as the pre-project community perceptions survey. Participants had significantly increased their willingness to reduce car use, and had significantly increased the level of importance they attached to carpooling, doing several things before returning home, and

travelling with others to reduce car use. No change of attitude was observed in people who were non-participants (control group).

1.4.1.3 Portland SmartTrips

The Portland, OR, SmartTrips program is modeled on the TravelSmart Australia program and uses direct individualized marketing techniques and community outreach to encourage residents in targeted geographic areas of the city to reduce drive-alone trips and increase walking, biking, transit and carpool trips. The Portland SmartTrips program was piloted in 2003, with the first large-scale project following in 2004; the project has since been implemented every year in a new area of Portland or to a new demographic (e.g., new residents, workplace commuters). Primary goals for the project include: reducing drive-alone trips; reducing vehicle miles driven by area residents, employees and customers; increasing awareness and raising acceptability of all travel modes; increasing walking, biking, transit, carpooling and car sharing trips; increasing neighborhood mobility and livability; and increasing bicycling and walking safety.

Each year in March, every household in a SmartTrips area receives a newsletter with a calendar of nearby walks, clinics and bike rides. The newsletter highlights SmartTrips programs and describes other transportation projects and programs, and how to use the transit agency's services. The newsletter also alerts residents to an order form that they will receive. Order forms are mailed out in waves each week, and allow residents to order a variety of maps, brochures, tips, and event schedules for every mode of transportation: walking, bicycling, transit, carpool, car sharing, and driving. Residents also choose one incentive with their order: a SmartTrips umbrella, Bandana Bicycle Map, or Transportation Options T-shirt. When residents return an order form, their request is processed and delivered within two weeks; all materials are delivered by bicycle delivery, and arrive in a vinyl tote bag with a personalized luggage tag. Three weeks after the order form is sent, a reminder postcard is mailed to each resident who does not return the order form; the postcard includes the web order form as well as the phone number they can call to receive another mailed order form. At the beginning of May, all residents receive a second newsletter reminding them to order materials and provide information about upcoming events and activities. Three additional newsletters are mailed every two months to everyone who orders materials or attends one or more of the walks and rides.

The program evaluation was based primarily on a random telephone survey of approximately 300 to 600 households in each SmartTrips area with a corresponding control group. Trip diaries from survey participants were also used to capture trip activity for the previous day with calls made over a two-week period. The program has yielded a reduction of 9% to 13% in drive-alone car trips by all area residents with a corresponding increase in walking, bicycling, and transit mode shares in the SmartTrips areas. Approximately 30% of all area residents either ordered materials or participated in a SmartTrips event or activity, and 20% of all households ordered materials.

Please mail or fax this form to Steve Hoyt, PDOT, 1120 SW 5th Avenue, Rm 800, 97204
Fax: 503-823-7576. We'll enter you in a drawing for great downtown gifts!

PLEDGE FORM

Yes, I want to:

- Save money
- Improve my health
- Cut air & water pollution

I pledge to try to shift at least ____ (number of downtown trips) each ____
(week, month) from driving alone to (circle one or more: carpool, vanpool, MAX,
bus, walk, bike, Flexcar, other). ____ I'm already traveling this way.

(Your signature & date)

(Your name and work address)

Thank you.
Whether one trip a day or one a month, every SmartTrip you choose makes a difference.
We sincerely appreciate your effort.

 Peter Hurley - 503.823.6345
peter.hurley@pdotrans.org

 Steve Hoyt - 503.823.7191
steve.hoyt@pdotrans.org

SMART TRIPS
DOWNTOWN

From Portland Office of Transportation, Sam Adams, Commissioner

Figure 1.11: Downtown Portland, OR, SmartTrips pledge

1.4.2 Sustained Impacts of Travel Blending

A U.K. study that identified barriers to changing travel behavior took a closer look at the reasons behind the mode choices made by participants (McGovern, 2005). Through keeping travel diaries and being exposed to awareness campaigns for four weeks, data collected from participants revealed reasons behind deciding to use predominantly personal cars for their trips. Older participants seemed to think the younger generation should be the mode changers.

Participants in general expressed the lack of public participation opportunities offered leading them to think their opinions do not change government decisions. Participants expressed that public transportation was unreliable; therefore not a favorable choice, while personal cars provided the most freedom and the most security and safety compared to other modes.

After a period of 10 months communicating the damaging environmental and health impacts of driving, a more in-depth understanding of issues associated with trip decision-making was observed. Although no modal shift was detected during the study period, knowledge provided through awareness campaigns was deemed helpful by participants in informing their trip-making decision process.

An in-depth review of travel-behavior changes gained through social marketing programs such as TravelSmart® and IndiMark® documented the following outcomes (Brög et al., 2009):

Table 1.3: Documented Impacts of Travel Blending on Travel Behavior

<i>IndiMark in Europe</i>	<i>Projects</i>	<i>Locations</i>	<i>Target population (people)</i>	<i>Relative Changes in Public Transportation shares (%)</i>
Germany	59	45	1,007,000	+ 19
Austria	23	15	228,200	+ 13
Sweden	25	19	163,800	+ 10
Switzerland	5	2	20,800	+ 10
UK	6	1	286,000	+ 6
TravelSmart in Australia, Europe and North America	Projects	Locations	Target population (people)	Relative Changes in Car Use (%)
Perth	24	1	408,500	- 11
Other Australia	10	4	338,800	- 12
UK	24	12	304,800	- 12
Other Europe	7	6	47,000	- 13
USA	12	9	47,500	- 8
Canada	6	1	4000	- 10

In addition to increases in public transportation shares observed as a result of deploying IndiMark® programs in Europe (6%-19%), even higher rates (48%) were noted where IndiMark® deployments were combined with rail system improvements, as opposed to only 23% attained through improvements without IndiMark®.

In the evaluation conducted by Brög et al. , the long-term impacts were monitored and were found to be sustainable even after several years.

Ma et al. (2016) conducted a quantitative evaluation of the combined effects of TravelSmart® and the built environment, concluding that marketing materials be made permanently and freely available to encourage ongoing targeted interventions. The study also asserted the importance of constant social-marketing interventions to accomplish a larger share of non-SOV modes, particularly if built environments are conducive to walking and bicycling.

2.0 EUROPEAN SEGMENT PROJECT

The purpose of this study was to explore a consumer market segmentation technique (SEGMENT) successfully used in Europe for its applicability to social marketing campaigns in the United States.

2.1 THE EUROPEAN SEGMENT PROJECT

The European SEGMENT project has developed a replicable and transferable market segmentation model to be used by all of the EU's 27 member states when designing social marketing campaigns to persuade people to change their travel behavior via TDM (what European's call "mobility management") and adopt more energy-efficient forms of transport (Intelligent Energy Europe, 2015). The SEGMENT project (2015) suggests the following benefits of a segmented approach:

- "The act of thinking about target groups will itself make a difference to the way in which mobility management [transportation demand management] campaigns are designed even before any data is collected. The act of thinking about different target groups and their specific needs and lifestyle characteristics will aid the creative dialogue around the initiatives and key messages being developed for the campaign.
- The collection of rich contextual data adds new insightful information to existing knowledge about mobility patterns and public perceptions and motivations.
- The data collected about baseline travel behavior and attitudes – and any subsequent segments – can be a powerful political tool. Survey data is likely to identify a significant minority or even majority of people who are dissatisfied with their current transport options and are likely to respond well to increased provision or incentivizing to change behavior."

The SEGMENT project analyzed over 10,000 responses to comprehensive attitudinal surveys containing over 100 questions to generate eight main attitudinal segments useful for the design of mobility social marketing campaigns. The eight audience segments include devoted drivers, image improvers, malcontented motorists, active aspirers, practical travelers, car contemplators, public transport dependents, and car-free choosers. Additional analysis produced 18 "golden questions" representing the smallest number of survey questions required to reproduce the eight market segments (Intelligent Energy Europe, 2015). A short list of golden questions is beneficial to quickly and accurately place individuals into differing segments to target messages and strategies, and utilize resources effectively.

The SEGMENT project concluded that most of their eight segments can be detected in all locations (27 EU member states); however, the proportion to which each segment is represented in each partner city differs. Additionally, the SEGMENT project analysis identified key dimensions of diversity across attitudinal groups which enabled a core set of attitudinal questions to be identified; from these different dimensions, the golden questions were produced (see Figure 2.1). The key issues found to discriminate the most between different people and determine the degree to which they are likely to use different modes of transport included:

- Whether or not a person currently has regular use of a car to drive.
- How likely a non-car driver is to drive in the next 12 months.
- How much driving is enjoyed and is seen to be a route to self-expression.

- How much a person sees themselves as a cyclist, bus user or pedestrian.
- How much cycling, walking or bus use is enjoyed.
- How much a person feels they should walk or cycle to keep fit.

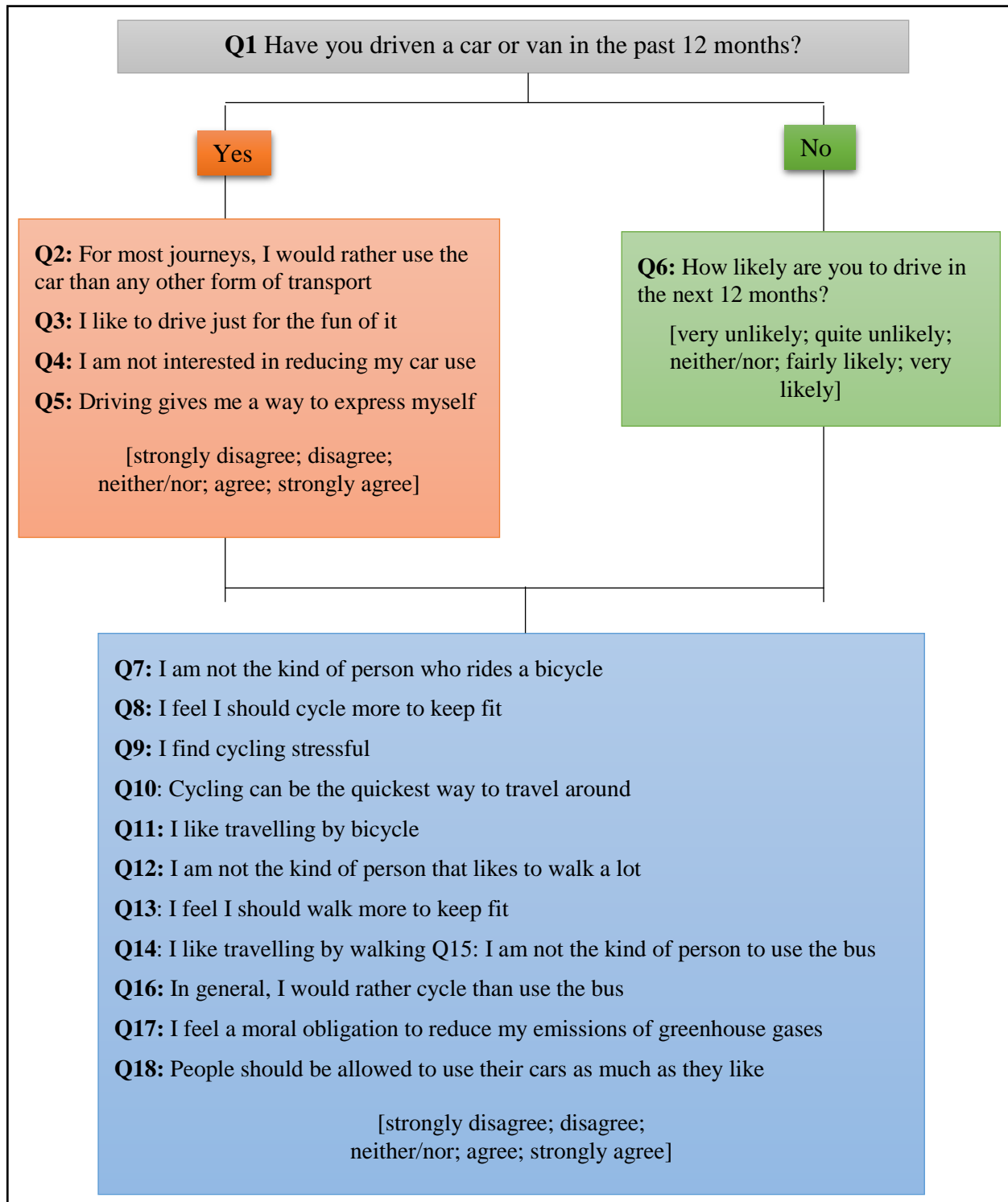


Figure 2.1: The SEGMENT project golden questions

2.1.1 SEGMENT Profiles

The SEGMENT project generated eight attitudinal segments listed below excerpted from Anable and Wright (2013 Annex 2).

1. “Devoted Drivers” were not convinced that other modes are realistic alternatives and therefore primarily used their cars for travel.
2. “Image Improvers” did not want any restrictions on driving, nonetheless somewhat concerned for the environment.
3. “Malcontented Motorists” found driving stressful and desired the reduction of car use, but found the alternatives not practical for their travel needs.
4. “Active Aspirers” were motivated by environmental awareness, and prefer walking and cycling to public transportation in short trips when trying to reduce car use.
5. “Practical Travelers” used cars for efficiency and practicality and had little tendency to change their habits.
6. “Car Contemplators” aspired to be car owners, desiring the freedom and independence driving offers.
7. “Public Transport Dependents” were not anti-car mode, had little interest in environmental issues, and were frustrated with transit service.
8. “Car-free Choosers” were conscientiously using healthy modes of transportation and deeply concerned about environmental issues.

2.1.2 SEGMENT Case Examples

Case studies that document the SEGMENT project can be found at <http://www.eltis.org/discover/case-studies>

3.0 METHODOLOGY

3.1 SURVEY DESIGN

The study utilized the same set of survey questions used by the European SEGMENT project. These questions came from the Health Care Facilities Questionnaire (Appendix A) conducted in London Borough of Hounslow (London Borough of Hounslow, 2011), adjusted for differences in the two metric systems. A major difference between this study and the European SEGMENT project is that to determine drivers/non-drivers for this study, respondents were asked how frequently they have driven a car/truck/van in the past 12 months (instead of asking “Have you driven in the past 12 months?”). Respondents who have driven less than one day per week were classified as non-drivers.

Most questions on the survey inquired about participants’ attitudes towards different modes of travel and were scored on a Likert scale from 1 to 5 (Strongly Disagree to Strongly Agree). In addition to the European questions, 22 additional questions were added to the survey that were thought would better separate the segments based on U.S. travel patterns (e.g., questions related to Uber/Lyft, telework, etc.). Of those 22 questions, six were given to drivers and the other 16 were given to both drivers and non-drivers. The list of additional questions is presented in Appendix B.

The survey was carried out in Florida, Oregon, and Virginia using panel data from Qualtrics, an online survey company. Participants were required to be 18 years or older, be employed part time or full time, and not have any physical or mental disability that prohibits them from driving/traveling independently. Additionally, quotas were placed on the data to mimic the demographics of commuters in the United States (e.g., age groups and gender).

A total of 2,882 responses were recorded with 1,197 respondents from Florida, 840 respondents from Oregon, and 895 respondents from Virginia. The data consists of 13.2% under 25 years old, 43.3% 25-44 years old, 43.5% over 45, 53% male, and 47% female. Safeguards were applied to protect against counterfeit responses such as response duration. After a soft launch, the median length to complete the survey was 13.9 minutes. Any response that was shorter than one-third of this median length was terminated. Respondents who gave the same answer across all questions were also removed. The filtered data set had 1,889 responses with 248 classified as non-drivers (99 from Florida, 76 from Oregon, and 73 from Virginia) and 1,641 classified as drivers (552 from Florida, 551 from Oregon, and 558 from Virginia).

3.2 METHODOLOGY FOR STATISTICAL ANALYSIS

Two phases of analysis with identical steps and methodologies were carried out. The first phase used only the questions taken from the European questionnaire, and the second phase included the 22 additional questions. By doing this, observations regarding how similar the two populations were in the first phase, and whether the additional questions help better identify the U.S. segments in the second phase, were able to be made.

The methodologies applied by Anable and Wright (2013) were followed closely . First, all questions in each group (62/78 questions for non-drivers and 73/90 questions for drivers) were used for clustering analysis to establish the segments. Hierarchical clustering using Wards' criterion was first applied to observe the structure of the data and to identify the potential numbers of clusters (Murtagh & Legendre, 2014); this was done with method "Ward.D2" in R. To help determine the best number of clusters to obtain stable results, the Dendrogram, the Elbow plot (Ketchen & Shook, 1996), and the AIC/BIC plot were observed. The interpretations of these graphs are summarized in Appendix C for readers without a background in statistics. The AIC/BIC scores were computed as described by Friedman et al. (2001) and plotted against the number of clusters (Friedman, Hastie, & Tibshirani, 2001). Next, the clusters' mean values obtained from hierarchical clustering was used to initiate the K-means procedure to obtain the final cluster solution. The reason for this second step is that hierarchical clustering using Wards' criterion does not conserve the space and thus may end up with a suboptimal solution.

Next, linear discriminant analysis was used to obtain a small set of questions, referred to as golden questions, to be used to predict cluster membership. First, a forward stepwise selection algorithm was used to find the variables that separate the clusters the most, based on the Wilk's Lambda criterion. This was performed by the *greedy.wilks* function in the R package "klaR." Next, this set of questions was used as inputs for linear discriminant analysis to produce the discriminant functions, which can be used to predict cluster membership. Finally, the accuracy (test error) of these discriminant functions was calculated by leave-one-out cross validation (Friedman et al., 2001) and state-wise cross validation (fit the model on two out of three states and predict the left-out state).

Lastly, demographic information was calculated for each group.

4.0 RESULTS AND FINDINGS

4.1 NON-DRIVER SEGMENTS

For the non-driver group, the hierarchical dendrogram is presented in Figure 4.1., and the Elbow curve, AIC, and BIC plots are presented in Figure 4.2.

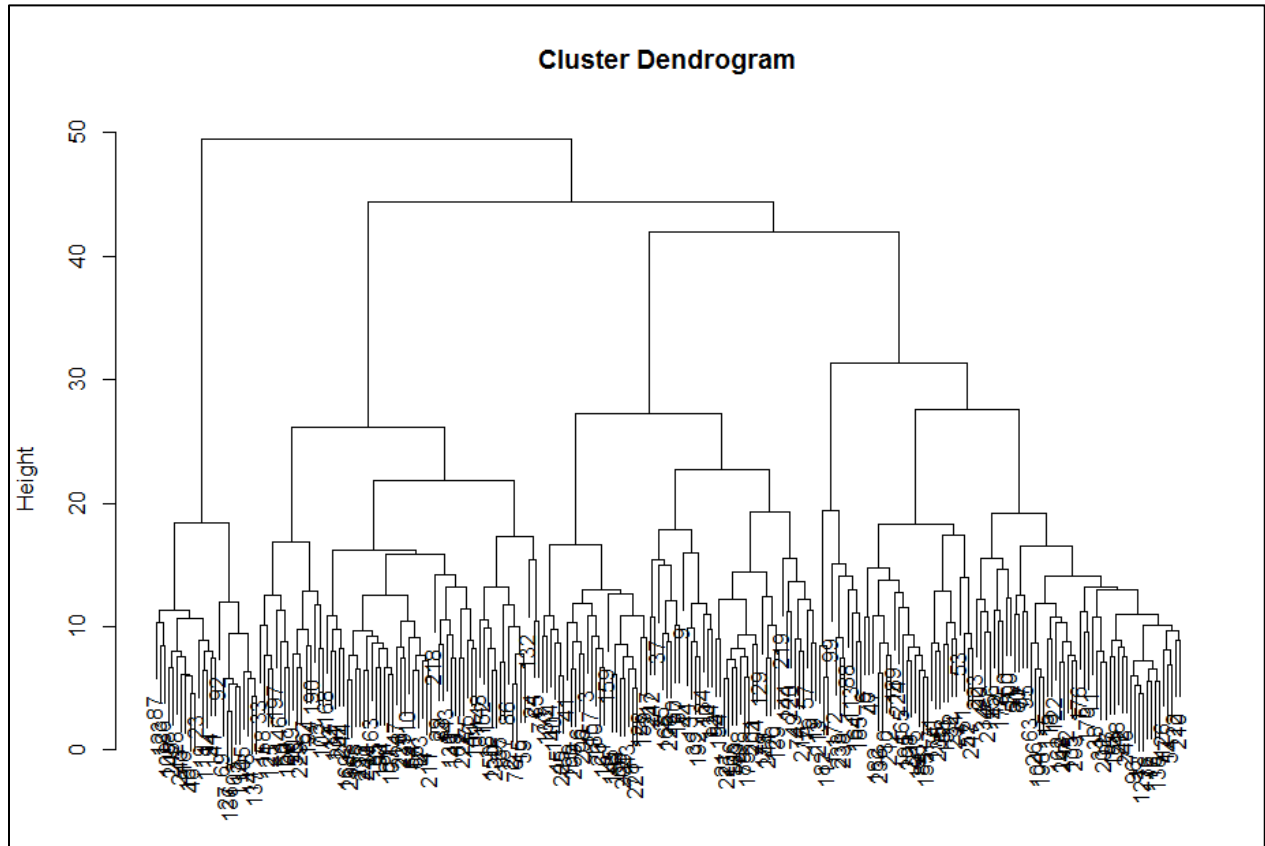


Figure 4.1: Non-driver group dendrogram

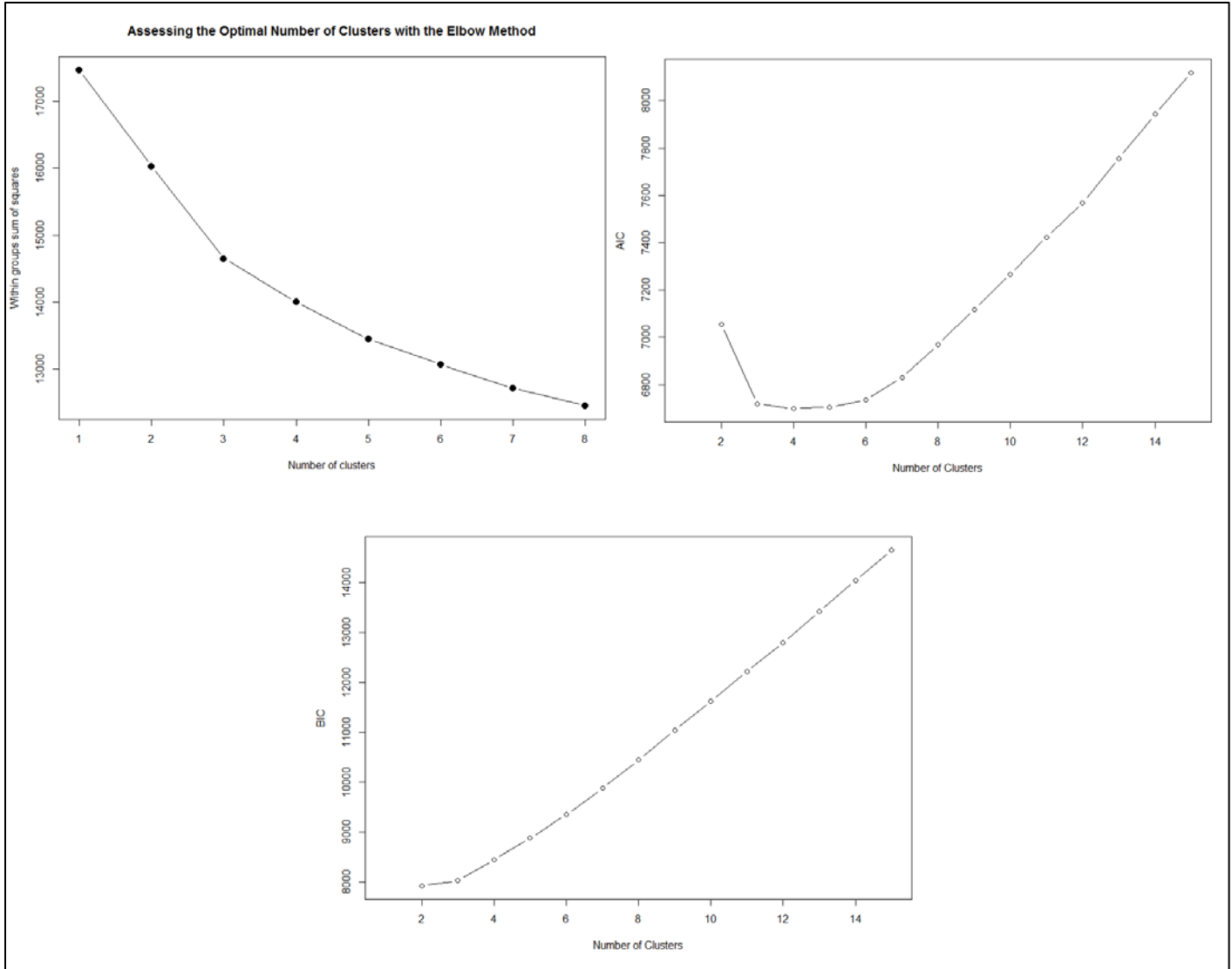


Figure 4.2: Non-driver group Elbow, AIC, and BIC plots

The graphs suggest that the optimal number of clusters is three or four. When observing the average values of responses, it was found that one of these groups responded strongly positively to all questions (about 4 or more on a Likert scale of 1-5). When clustering with five groups, it was found that another group responded strongly negatively to all questions. In reality, it is impossible that anyone would respond positively or negatively to all questions because the questions inquire about both positive and negative attitudes to all modes of transport. Furthermore, these two groups only take small proportions of the sample, 10% and 4%, respectively. Therefore, it was determined that these two groups are not genuine respondents and we removed them from the study. The dendrogram for the purged data is presented in Figure 4.3.

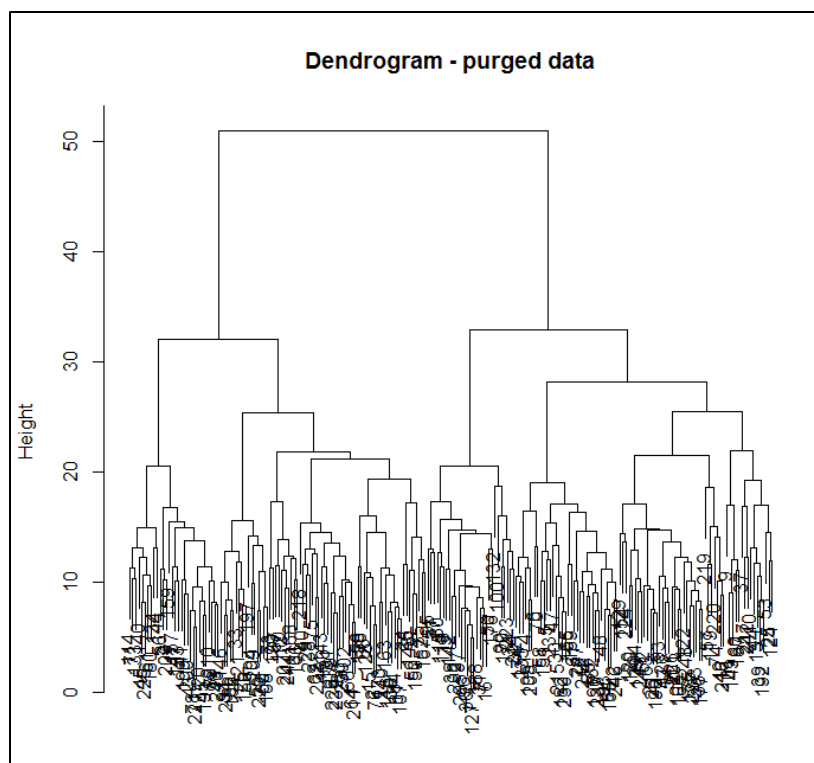


Figure 4.3: Non-driver group dendrogram of purged data

After purging the two uninformative groups, the sample was clustered again with three groups. The sample was split evenly, with 36%, 32%, and 32% of respondents in the three clusters. Linear discriminant analysis (LDA) was then applied to these three clusters. Table 4.1 presents the mean responses of each group to the golden questions. The questions highlighted in yellow were also found as golden questions in the European SEGMENT project. In the following tables, an average answer ranges from 1 (strongly disagree) to 5 (strongly agree). The green and red shading of the cells indicate how close an answer is to 1 (strongly disagree) or 5 (strongly agree); the darker red shade indicates that the answer is closer to 1, and the darker green shade indicates that the answer is closer to 5. White cells indicate that the average score is neutral. For example, in response to the question “I am NOT the kind of person to use public transportation”, Cluster 1 slightly agrees with an average score of 3.25, Cluster 2 strongly disagrees with an average score of 1.39, and Cluster 3 slightly disagrees with an average score of 2.29 as depicted in Table 4.1.

Table 4.1: Non-Driver Group Mean Responses to Golden Questions

16 Golden Questions	Cluster 1	Cluster 2	Cluster 3
I am NOT the kind of person to use public transportation	3.252747	1.390625	2.298246
I find traveling by public transportation stressful	3.307692	2.3125	3.508772
Public transportation can be the quickest way to get around	2.692308	3.5	2.350877
I am NOT the kind of person who rides a bicycle	3.131868	3.125	1.561404
Bicycling is a very healthy way to travel around	3.483516	4.125	4.298246

I feel I should cycle more to keep fit	3.087912	3.578125	4.210526
I tend NOT to bicycle because I am not fit enough	3.065934	2.71875	1.859649
Bicycling gives me a way to express myself	2.857143	2.546875	3.631579
I would like to travel by car/truck/van more often than I have recently	3.307692	2.09375	3.280702
How likely are you to increase your driving to more than 1 day per week in the next 12 months?	3.164835	2.015625	3.175439
It is important to reduce the number of cars/trucks/vans on the road	3.131868	3.984375	3.508772
What I do personally can make a real difference to climate change	3.032967	3.796875	3.578947
I like traveling by railroad	2.571429	3.796875	2.859649
I like traveling by walking (to/from destination)	2.956044	4.203125	4.105263
I am NOT the kind of person that likes to walk a lot	2.868132	1.546875	1.684211
I feel I should walk more to keep fit	3.538462	4.25	4.22807
Percentage in sample	36%	32%	32%

*The questions highlighted in yellow were also found as golden questions in the European SEGMENT project.

Out-of-sample accuracy of LDA is presented in Table 4.2; the first column is for leave-one-out cross validation (LOOCV) and the next three are for state-wise cross validation.

Table 4.2: Non-Driver Group LDA Accuracy

Group	LOOCV	FL	OR	VA
1	94.5%	95.2%	90.5%	89.3%
2	82.8%	92.9%	100.0%	84.0%
3	82.5%	68.4%	58.3%	93.8%

This process was repeated with the 16 additional survey questions given to non-drivers. Table 4.3 presents the new golden questions and mean responses to them. Again, the questions highlighted in yellow were also found as golden questions in the European SEGMENT project. The questions highlighted in orange belong with the additional questions.

Table 4.3: Non-Driver Group Mean Responses to Golden Questions, with Added Questions

16 Golden Questions	Group 1	Group 2	Group 3
I am NOT the kind of person to use public transportation	2.804878	1.47619	3.586957
I have no need to drive as public transport/walking/cycling are all adequate	0.073171	0.428571	0.043478
There are many problems with using public transportation	2.95122	2.964286	4.021739
My employer reimburses bicycle commuting expenses	2.768293	1.583333	1.695652
I like traveling by local bus or trolley bus	3	3.72619	1.76087
I do NOT need to have a car/truck/van	3	3.833333	2.347826
Finding a parking space at work is difficult	3.134146	3.011905	2.043478
I do NOT know anyone with whom to carpool	2.890244	3.440476	3.630435

I had a bad experience as a carpool passenger in the past	2.54878	1.940476	2.173913
I like traveling by ferryboat	2.926829	3.309524	1.913043
I feel a moral obligation to reduce the emission of greenhouse gases	2.95122	3.785714	2.934783
I like traveling by subway or elevated	3.146341	3.583333	1.782609
I like traveling by taxicab	2.914634	2.607143	1.608696
Traffic congestion is a problem in my local area	3.04878	4.202381	3.608696
In general, I would rather walk than use the bus	2.963415	3.72619	3.543478
Walking can be the quickest way to travel for short journeys	3.341463	3.857143	2.76087

*The questions highlighted in yellow were also found as golden questions in the European SEGMENT project; the questions highlighted in orange were additional questions added for this study.

Table 4.4 presents the LDA accuracy with the added questions; the first column is for LOOCV and the next three are for state-wise cross validation.

Table 4.4: Non-Driver Group LDA Accuracy, with Added Questions

Group	LOOCV	FL	OR	VA
1	91.5%	90.3%	92.3%	92.0%
2	94.0%	89.7%	93.8%	100.0%
3	93.5%	73.7%	91.7%	93.3%

The discriminant functions parameters, which are used to predict cluster membership, are given in Appendix D. Table 4.5 presents demographic distribution for each segment (when analyzed with additional questions).

Table 4.5: Non-Driver Group Demographic Distributions

		Group 1	Group 2	Group 3
Age	18-24	40%	13%	28%
	25-34	24%	24%	22%
	35-44	15%	26%	24%
	45-54	13%	15%	20%
	55-64	6%	12%	7%
	65-74	1%	8%	0%
	75+	0%	1%	0%
Gender	Male	60%	44%	48%
	Female	37%	54%	50%
	Transgender	2%	2%	0%
Employment	Employed Full-time	63%	65%	61%
	Employed Part-time	37%	35%	39%
	Student	4%	0%	2%
Number of children under 2 years in household	0	83%	98%	89%
	1	13%	2%	11%
	2	2%	0%	0%
	3	1%	0%	0%
Number of children 2-18 years in household	0	63%	79%	61%
	1	17%	15%	26%
	2	13%	6%	13%
	3	6%	0%	0%

4.2 DRIVER SEGMENTS

Similar to the non-driver group, after clustering a cluster that responded positively to all questions (about 5% of data) was observed; no all-negative cluster was found as the data was further segmented with up to 10 segments. The hierarchical dendrogram is presented in Figure 4.4, and the Elbow curve, AIC, and BIC plots are presented in Figure 4.5.

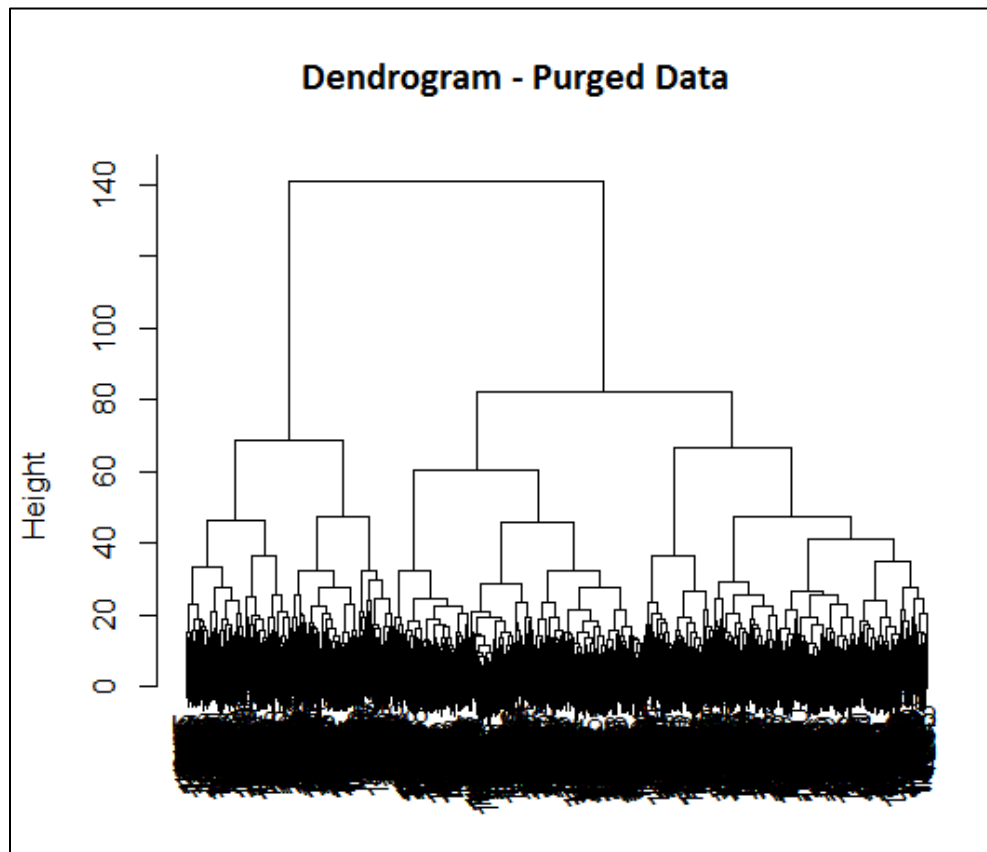


Figure 4.4: Driver group dendrogram - purged data

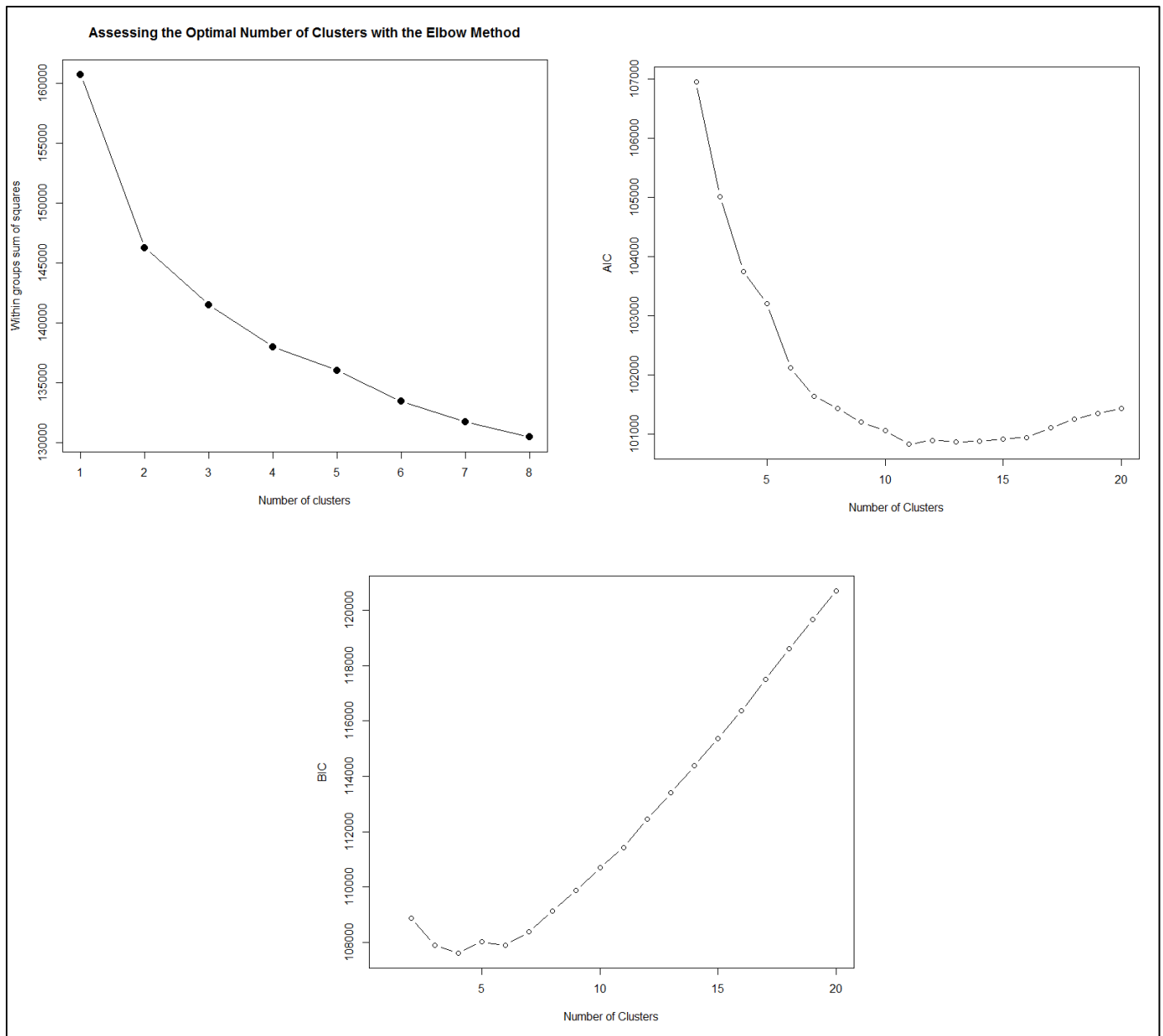


Figure 4.5: Driver group Elbow Curve, AIC, and BIC

Based on the graphs, it was decided to segment the sample by four clusters. LDA was then applied to the four clusters. Table 4.6 presents the mean responses of each group to the golden questions. The questions highlighted in yellow were also found as golden questions in the European SEGMENT project.

Table 4.6: Driver Group Mean Responses to Golden Questions

15 Golden Questions	Group 1	Group 2	Group 3	Group 4
I am NOT the kind of person to use public transportation	4.009967	2.848889	2.231183	3.597727
I like traveling by bicycle	1.707641	2.337778	3.739247	3.456818
In general, I would rather bicycle than use the bus	2.265781	2.326667	3.647849	3.743182

I am NOT the kind of person who rides a bicycle	3.684385	3.551111	1.991935	2.170455
It is important to reduce the number of cars/trucks/vans on the road	2.621262	3.531111	4.094086	3.168182
I am NOT interested in reducing my car/truck/van use	4.093023	2.882222	2.155914	3.434091
If I could, I would gladly do without a car/truck/van	1.461794	2.651111	3.376344	2.070455
People should be allowed to use their cars/trucks/vans as much as they like	4.431894	3.593333	3.349462	4.206818
I feel a moral obligation to reduce the emission of greenhouse gases	2.352159	3.322222	3.983871	2.979545
I like traveling by streetcar or trolley car	1.408638	2.833333	3.188172	2.361364
I like traveling by subway or elevated	1.461794	2.971111	3.30914	2.543182
I like traveling by taxicab	1.491694	2.535556	2.69086	2.290909
Traffic problems will reduce if I drive less	2.013289	2.971111	3.38172	2.515909
I like traveling by walking (to/from destination)	2.315615	3.335556	4.134409	3.697727
Walking provides freedom and flexibility	3.491694	3.564444	4.255376	3.922727
Percentage in sample	19%	29%	24%	28%

*The questions highlighted in yellow were also found as Golden Questions in the European SEGMENT project.

Out-of-sample accuracy of LDA is presented in Table 4.7; the first column is for LOOCV and the next three are for state-wise cross validation.

Table 4.7: Driver Group LDA Accuracy

Group	LOOCV	FL	OR	VA
1	84.4%	91.1%	75.3%	85.4%
2	85.6%	81.0%	84.3%	89.1%
3	83.3%	87.2%	87.3%	75.9%
4	79.5%	80.6%	82.4%	78.5%

The process was repeated with the 22 additional questions. Table 4.8 presents the new golden questions and mean responses to them. Again, the questions highlighted in yellow were also found as golden questions in the European SEGMENT project. The questions highlighted in orange belong with the additional questions.

Table 4.8: Driver Group Mean Responses to Golden Questions, with Additional Questions

15 Golden Questions	Group 1	Group 2	Group 3	Group 4
I am NOT the kind of person to use public transportation	2.887168	4.081967	2.171014	3.480519
I like traveling by bicycle	2.314159	1.809836	3.66087	3.5
I am NOT the kind of person who rides a bicycle	3.584071	3.563934	2.066667	2.147186
In general, I would rather bicycle than use the bus	2.283186	2.42623	3.547826	3.75974
I would rather be a carpool passenger to read, use smartphones, or sleep on the way to work	2.909292	1.718033	3.536232	2.790043
Reducing my car/truck/van use would make me feel good	3.214602	2.07541	3.973913	3.012987
Driving gives me a way to express myself	3.017699	3.527869	2.713043	3.642857

If I could, I would gladly do without a car/truck/van	2.595133	1.409836	3.44058	2.201299
People should be allowed to use their cars/trucks/vans as much as they like	3.654867	4.436066	3.281159	4.149351
I like traveling by ferryboat	3.053097	1.878689	3.423188	2.876623
I feel a moral obligation to reduce the emission of greenhouse gases	3.252212	2.321311	4.02029	3.101732
Environmental threats such as global warming have been exaggerated	2.544248	3.311475	1.733333	2.779221
I like traveling by streetcar or trolley car	2.789823	1.409836	3.228986	2.4329
I like traveling by walking (to/from destination)	3.272124	2.422951	4.130435	3.735931
I tend NOT to walk much because I am not fit enough	2.502212	2.242623	1.684058	1.991342

*The questions highlighted in yellow were also found as Golden Questions in the European SEGMENT project; the questions highlighted in orange were additional questions added for this study.

Table 4.9 presents the LDA accuracy with the added questions; the first column is for LOOCV and the next three are for state-wise cross validation.

Table 4.9: Driver Group LDA Accuracy, with Added Questions

Group	LOOCV	FL	OR	VA
1	83.6%	84.6%	84.4%	81.0%
2	83.9%	86.7%	78.9%	84.2%
3	80.0%	79.3%	81.3%	78.7%
4	79.9%	80.2%	82.6%	76.9%

The discriminant functions parameters, which are used to predict cluster membership, are given in Appendix E.

Table 4.10 presents demographic distribution for each segment (when analyzed with additional questions).

Table 4.10: Driver Group Demographic Distributions

		Group 1	Group 2	Group 3	Group 4
Age	18-24	9%	13%	12%	10%
	25-34	24%	22%	27%	26%
	35-44	21%	17%	22%	18%
	45-54	21%	20%	16%	21%
	55-64	16%	22%	16%	19%
	65-74	8%	5%	7%	6%
	75+	0%	0%	0%	0%
Gender	Male	57%	54%	55%	49%
	Female	43%	45%	44%	51%
	Transgender	0%	0%	0%	0%
Employment	Employed Full-time	84%	79%	87%	83%
	Employed Part-time	16%	21%	13%	18%
	Student	0%	2%	2%	1%
	0	93%	94%	93%	93%

Number of children under 2 years in household	1	7%	5%	6%	6%
	2	1%	0%	0%	1%
Number of children 2-18 years in household	0	63%	64%	62%	67%
	1	20%	14%	21%	15%
	2	12%	16%	11%	13%
	3	4%	3%	3%	5%
	4	1%	2%	2%	1%
	5	0%	0%	1%	0%

5.0 DISCUSSION

5.1 FINDINGS

For the non-drivers group, when only the questions from the European SEGMENT project were included, the results are quite similar to the European study. About half of the golden questions are the same as the ones identified by Anable and Wright (2013). Among the three non-driver segments, the attitudes of segment 3 are nearly identical to the European project's Car-Free Chooser group, and those of segment 2 are quite similar to the European project's Public Transport Dependent group. Instead of the European project's Car Contemplators group, the third group in this study (group 1) responded relatively neutrally to most transport modes. When including the 16 additional questions to the process, it was observed that most of the European golden questions were removed and replaced by some of the additional questions added in this study. Furthermore, LDA's prediction accuracy increases significantly. This confirms the belief that the additional questions help classify the non-driver segments better in the United States. The segments' profiles change only slightly with the additional questions.

For the drivers group, when only the questions from the European SEGMENT project were included, the results are also quite similar. About half of the golden questions are the same. Based on the mean responses, it is observed that this study's segments 1, 2, 3, 4 are similar to the European project's segments of Devoted Drivers, Image Improvers, Active Aspirers, and Practical Travelers, respectively. When including the 22 additional questions to the process, three of those were identified as important golden questions, but the LDA accuracy unexpectedly drops slightly. This happens because the added questions increase dimensionality and change the Euclidean distances and, therefore, the 15 golden questions can explain a smaller proportion of variation than before. Interestingly, in the non-drivers case, the additional questions were strong enough to offset dimensionality and further increase prediction power. The fact that many of them became golden questions complements this belief.

The discriminant functions provided in Appendix D and E can be used in the future to inexpensively segment any population for social marketing purposes. However, uses of these functions outside of the surveyed areas should be carried out with caution because citizens in different areas may have significantly different attitudes in transport.

5.2 SEGMENTS PROFILING

Based on the mean responses of each group to all of the survey questions, the following group profiles have been constructed.

5.2.1 Non-driver groups

Groups 1 through 3, as denoted in the results, are the non-driver groups and can be described as follows.

5.2.1.1 *Group 1 – Open-minded and Practical Travelers*

This group somewhat likes driving or traveling by car, truck, or van as a passenger. They also believe that people should be allowed to use their cars, trucks, or vans as much as they like. However, they are also open-minded about other modes of transportation. They have positive attitudes towards walking and biking and are aware of the health benefits from walking and biking. They understand that society is facing environmental problems, but do not have a strong drive to act on this situation. They do not like or dislike other modes of transportation such as bus, train, ferryboat, or subway.

5.2.1.2 *Group 2 – Car-free Choosers (same as European Segment)*

This group does not feel the need to own a car as they believe that public transportation, walking, and cycling are adequate for their daily life. They also think that owning a car, truck, or van is expensive, and therefore do not have any incentive to invest in them. As a result, they are unlikely to increase their driving frequency. However, they still enjoy traveling in a car, truck, or van as a passenger. They also have positive attitudes towards many types of public transportation such as bus, train, ferryboat, or subway. They love walking and biking and strongly believe that walking and biking are very healthy. They also pay a lot of attention to the environmental problems that society is facing and strongly believe that global warming is not an exaggerated threat. If this group dislikes any mode of transportation, it might be motorcycle.

5.2.1.3 *Group 3 – Car Contemplators (same as European Segment)*

This group loves traveling by car, truck, or van, whether they are driving or not. They do not like traveling by public transportation such as bus, train, ferryboat, or subway because they think that they are both slow and stressful. They believe that owning a car, truck, or van is a sign of success and they provide status and prestige to the owner. As a result, they feel that people should be allowed to drive as much as they would like. They do not like biking or walking as a way to get to places, but are aware of the health benefits. They are also aware of environmental problems and do not believe that global warming and climate change threats have been exaggerated. However, they do not feel that they need to personally act to solve these problems.

5.2.2 Driver Groups

Group 4 through 7, as denoted in the results, are the driver groups and can be described as follows.

5.2.2.1 *Group 4 - Malcontented Motorists & Non-biker*

This group likes driving, but not as much as the car lovers and devoted drivers do. They agree that it is important to reduce the number of cars, trucks, and vans on the road due to traffic noise and pollution. They also feel responsible about environmental problems and do not believe that climate change and global warming have been exaggerated. They somewhat believe that reducing car usage can help stop climate change. Nevertheless, they do not enjoy public transportation because driving is faster. Therefore, they do not have many options besides

driving. A distinctive feature of this group is that they dislike bicycles and motorcycles, even though they acknowledge the health benefits of bicycling.

5.2.2.2 *Group 5 – Car Lovers / Devoted Drivers (same as European Segment)*

This group really loves to drive and does not want to cut down their car/truck/van use, and believes that there is no realistic alternative to driving. They believe that driving is a way to express themselves. As a result, they strongly believe that people should be allowed to use their car, truck, or van as much as they like. They have very negative attitudes towards biking and walking even though they understand the health benefits. They also have very negative attitudes towards any kind of public transportation and believe that cars, trucks, and vans are faster, cheaper and safer. However, they do not think that they are too dependent on cars, trucks, and vans. They also do not enjoy carpooling. They do not agree that cars, trucks, or vans create noise and odor nuisance or lead to an unhealthy lifestyle. Regarding environmental issues and climate change, this group somewhat believes that environmental threats have been exaggerated.

5.2.2.3 *Group 6 – Active Aspirer (same as European Segment)*

This group does not enjoy driving as much as people in other groups and would gladly cut down their car, truck, or van use if they could. They believe that driving is quicker than transportation but not cheaper because owning a car, truck, or van is expensive. They do not like traveling by taxicab and motorcycle. They have positive attitudes toward public transportation such as bus, subway, railroad, and ferryboat. They also enjoy biking and walking and highly appreciate the health benefits. They are highly aware of environmental responsibilities and climate change and would like to act on them. Therefore, this group believes that it is important to reduce the number of cars, trucks, and vans due to traffic noise and odor, and to solve environmental issues. If this group has to use a car to get to work, they would like to carpool.

5.2.2.4 *Group 7 – Open-minded Car Lovers*

Just like the Car Lovers/Devoted Drivers group, this group really loves to drive, does not want to cut down their car, truck or van use, and believes that there is no realistic alternative to driving. They strongly believe that people should be allowed to use their car/truck/van as much as they like and think that driving is a way to express themselves. Since they believe that driving is cheaper and quicker, they have unfavorable views toward public transportation. Nevertheless, they still like traveling by walking and biking and highly appreciate the health benefits. Despite their love for driving, this group feels responsible about environmental issues and does not believe that climate change and global warming have been exaggerated. Therefore, they think that it is important to reduce the number of car/truck/vans because of traffic noise and odor. This group is also open to carpooling.

5.3 SEGMENT REPRESENTATION BY STATE

The distribution of each of the seven segments (three non-driver and four driver) are shown in Figure 5.1. As viewable in this figure, the representation of the seven segments varies by state. Florida (FL) has the largest number of segments 3, 5 and 7, which are the Car Contemplators,

Car Lovers/Devoted Drivers, and Open-minded Car Lovers, respectively. Oregon (OR) has the largest number of segments 2 and 6, which are the Car-free Choosers and Active Aspirers, respectively. Finally, Virginia (VA) has the largest number of segments 1 and 4, which are the Open-minded and Practical Travelers and Malcontented Motorists, respectively.

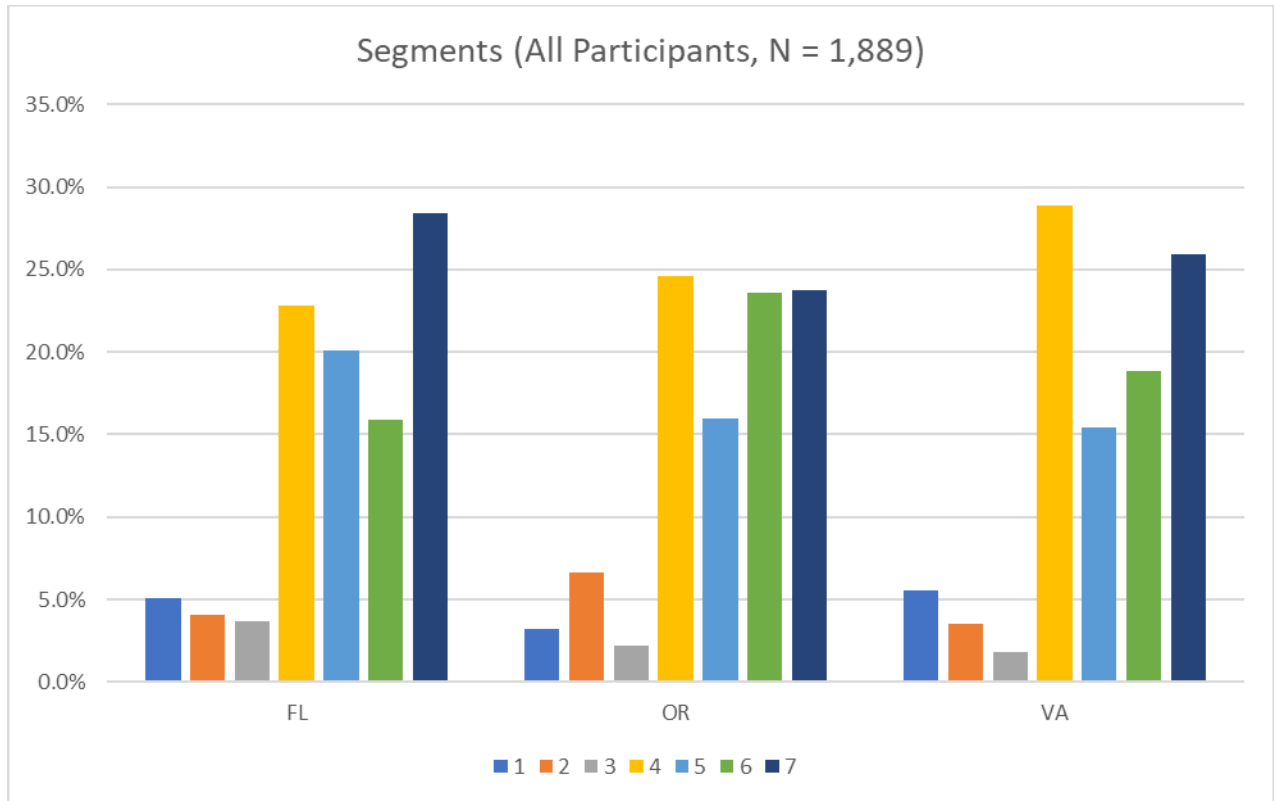


Figure 5.1: Distribution of segments by state

6.0 CONCLUSIONS AND FUTURE WORK

This study replicated the European’s SEGMENT methodology to determine whether their “golden questions” accurately segment markets in the United States. Individuals were surveyed using the long list of questions and discriminate analysis was applied to identify the most powerful questions among the segments. This study found that a unique set of questions most accurately predicts segment membership in the United States. Table 6.1 compares the accuracy of the U.S. golden questions to the European golden questions at predicting segment membership for each of the seven segments found by this study. As seen in this table, accuracy increases for each group, except for group 5, when using the U.S. set of golden questions.

Table 6.1: LDA Accuracy of Segments using U.S. and European Golden Questions

Group	LOOCV: U.S Golden Questions	LOOCV: European Golden Questions
1	91.50%	74.39%
2	94.00%	89.29%
3	93.50%	69.57%
4	83.60%	74.39%
5	83.90%	89.29%
6	80.00%	69.57%
7	79.90%	76.77%

A short list of golden questions is beneficial to quickly and accurately place individuals into differing segments to target messages and strategies, and utilize resources effectively.

Major contributions of this project are the validation of a successful existing segmentation technique for applicability in the United States, which will maximize the impact of TDM social marketing campaigns on changing travel behavior. This research will build on previous research by Intelligent Energy Europe focused in EU’s 27 member states and expands the demographic profile and location. Future research could expand to other areas of the United States and investigate whether the golden questions accurately predict segment fit. Golden questions can be added to existing surveys to gather information about the proportion of individuals who belong to differing segments in an area. Additionally, limited resources can be better allocated to target those segments that are most susceptible to behavior change.

The results of this research can also be used to support future TDM social marketing campaigns in these metropolitan areas. For example, a current FDOT-funded project uses a community-based social marketing approach to encourage Tampa Bay residents to increase walking and biking, increase use of transit, reduce traffic congestion, and create a more healthy and livable community. A program website offers personalized information to each household member based on their stage of change and mode preference. Future iterations of this community-based social marketing project could leverage the results of this research to better segment household members and tailor information unique to their needs and attitudes.

Finally, the guidance developed from this project will allow communities to easily classify and identify segments from which the appropriate services and incentives can be designed. An Excel tool has been developed for this project which allows users to identify individual segment

membership based on responses to the golden questions. These golden questions should reduce the cost, if not the need, for custom segmentation studies.

The Excel prediction tool is available at https://pdxscholar.library.pdx.edu/trec_data/2/. The objective of this tool is to provide transit agencies, transportation demand management (TDM) professionals, and others with a tool to predict market segment membership of individuals. This tool includes: the “golden question” survey questions that can be added to existing surveys to predict segment membership of each individual taking the survey; data sheets that can be used to enter the collected survey data; calculations to obtain the predicted segment membership of respondents; and descriptions of the seven driver and non-driver segments.

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8.0 APPENDICES

APPENDIX A
SEGMENT QUESTIONNAIRE

A Travel patterns

A.1 Do YOU have a driving licence for a car?

☐ Yes ☐ No

A.2a How many cars does your HOUSEHOLD have available for private use?

(please do not include cars as part of a car club)

Please tick ONE box only

☐ 0 ☐ 1 ☐ 2 ☐ 3 or more

A.2b Are you or anyone else in your household a member of a car club (eg Streetcar; City Car Club)?

☐ Yes ☐ No

A.3 How many bicycles are available for use by YOU?

Please tick ONE box only

☐ 0 ☐ 1 ☐ 2 ☐ 3 or more

A.4 About how long would it take you to walk from your home to your nearest public transport stop (place where you could get on a bus or tube)?

Please tick ONE box only

2 mins or less ☐ 3-5 mins ☐ 5-10 mins ☐ 10-15 mins ☐ 15-20 mins ☐ 20-30 mins ☐ 30 mins or longer ☐ Don't know ☐

A.5 For all journeys combined, in the past 12 months, how frequently have you used each type of transport?

Please tick one box per row

	Never	Less than once a month	1-3 days/month	About 1 day/week	2-4 days/week	5-7 days/week
a Car as a driver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Car as a passenger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Local bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Underground/ tube	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Bicycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Walking (to/from a destination)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Scooter/motorcycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Train	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A.6 What would you say is your MAIN mode of travel for each of the following purposes?

Main mode in this case means the mode that covers the longest distance on your journey.

If this is different in summer or winter, answer with the mode you used the last time you made the journey:

Please tick one box per row

	Car	Bus	Tube	Walk	Cycle	Scooter/mc	Other	N/A
a To work/study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b For food shopping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c To visit friends/family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Leisure/pleasure (eg restaurants, cinema)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Take children to/from school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A.7 In the past 12 months, have any of these events happened to you?

Tick ALL that apply

- | | | | |
|---|---|---|---|
| a | <input type="checkbox"/> Started working/changed your place of employment | h | <input type="checkbox"/> Child leaves home/goes to university |
| b | <input type="checkbox"/> Started university | i | <input type="checkbox"/> Bought a car |
| c | <input type="checkbox"/> Stopped working/retired | j | <input type="checkbox"/> Got rid of a car |
| d | <input type="checkbox"/> Finished university | k | <input type="checkbox"/> Obtained a driving licence |
| e | <input type="checkbox"/> Moved house | l | <input type="checkbox"/> New health problem |
| f | <input type="checkbox"/> Birth/adoption of a child | m | <input type="checkbox"/> Other/none of the above |
| g | <input type="checkbox"/> Child started school/a new school | | |

A.8 Compared to a time TWO YEARS AGO, please indicate whether your use of each type of transport has changed:

Please tick one box per row

- | | Much more | A little more | About the same | A little less | Much less |
|-----------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| a Car as a driver | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| b Car as a passenger | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| c Local bus | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| d Underground/ tube | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| e Bicycle | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| f Walking (to/from a destination) | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| g Scooter/motorcycle | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |
| h Train | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ | <input type="checkbox"/> ₄ | <input type="checkbox"/> ₅ |

B Your visits to health care facilities

B.1 Which Health Facility do you visit most often?

Please tick ONE box only

TW1 – Twickenham

- ☐ ₁ Cole Park Surgery
☐ ₂ St Margaret's Medical Practice

TW3 – Hounslow

- ☐ ₃ Blue Wing Family Doctor's Unit
☐ ₄ The Practice Heart of Hounslow
☐ ₅ Hounslow Medical Centre
☐ ₆ Willow Practice
☐ ₇ Hounslow Family Practice
☐ ₈ Firstcare Practice
☐ ₉ Bath Road Surgery
☐ ₁₀ Green Practice
☐ ₁₁ Kingfisher Practice
☐ ₁₂ Redwood Surgery
☐ ₁₃ Chestnut Practice
☐ ₁₄ Hibernia House Surgery

TW4 – Hounslow West and Cranford

- ☐ ₁₅ Greenbrook Chinchilla

- ☐ ₁₆ Clifford Road Surgery

TW5 – Heston and Cranford

- ☐ ₁₇ Cranford Medical Centre
☐ ₁₈ Dr Sood's Practice
☐ ₁₉ Jersey Practice
☐ ₂₀ Skyways Medical Centre
☐ ₂₁ Greenbrook Heston

TW7 – Isleworth and Osterley

- ☐ ₂₂ Greenbrook Isleworth
☐ ₂₃ Thornbury Road Centre for Health
☐ ₂₄ Grove Medical Centre
☐ ₂₅ Spring Grove Medical Practice

TW8 – Brentford

- ☐ ₂₆ Albany Practice
☐ ₂₇ Brentford Group Practice
☐ ₂₈ Greenbrook Manor
☐ ₂₉ Brentford Family Practice

TW13 – Feltham and Hanworth

- ☐ ₃₀ Queens Park Medical Practice
☐ ₃₁ Mount Medical Practice
☐ ₃₂ St David's Practice
☐ ₃₃ Manor House Practice
☐ ₃₄ Clifford House Medical Practice
☐ ₃₅ Little Park Medical Surgery
☐ ₃₆ The Practice, Feltham Centre for Health
☐ ₃₇ Twickenham Park Medical Centre

TW14 – Feltham and Bedfont

- ☐ ₃₈ Grove Village Medical Centre
☐ ₃₉ Carlton Surgery
☐ ₄₀ Gill Medical Practice
☐ ₄₁ Pentelow Practice
☐ ₄₂ Hatton Medical Practice
☐ ₄₃ Greenbrook Bedfont

continued on next page

B.1 continued**W4 – Chiswick and Bedford Park**☐_{4a} WEST4GPs☐_{4b} Wellesley Road Practice☐_{4c} Glebe Street Surgery☐_{4d} Chiswick Health Practice☐_{4e} Grove Park Surgery☐_{4f} Crossley House Surgery☐_{4g} Chiswick Family Doctors Practice☐_{4h} Grove Park Terrace Surgery☐_{4i} Holly Road Medical Centre**B.2 Using your answer to question B.1****How many times did you visit this health facility in the past 12 months?***Please tick ONE box only*

Never

2 times or less

3-6 times

6-12 times

13-24 times

25 times or more

☐₁☐₂☐₃☐₄☐₅☐₆**B.3 What would you say is your MAIN mode of travel TO the health facility?***Please tick ONE box only*☐₁ Drive a car alone☐₂ Tube/ Underground☐₃ Taxi☐₄ Car passenger☐₅ Cycle☐₆ Train☐₇ Bus☐₈ Walk☐₉ Other**B.4 What is the distance between your home and this health facility?***Please tick ONE box only*

Less than

1km

1km-3km

3km-5km

5km-10km

10km-15km

More than

15km

☐₁☐₂☐₃☐₄☐₅☐₆**B.5 How long does it usually take you to travel door to door to this health facility?***Please tick ONE box only*

Less than

5 mins

5-10 mins

10-15 mins

15-20 mins

20-30 mins

More than 30 mins

☐₁☐₂☐₃☐₄☐₅☐₆**B.6 What are the reasons for you usually travelling to health facility appointments using your MAIN mode?***Tick ALL that apply*a ☐₁ It is good for my healthh ☐₈ I enjoy itb ☐₂ The distance is too short to use any other modei ☐₉ It is easyc ☐₃ It is too far to use any other modej ☐₁₀ It is flexibled ☐₄ I cannot get there any other wayk ☐₁₁ It is good for the environmente ☐₅ There is restricted or no parking at the health centrel ☐₁₂ It fits in with my familyf ☐₆ It is the cheapestm ☐₁₃ Other/none of the aboveg ☐₇ It is the fastest**B.7 Please say how far you agree/ disagree with the following:***Please tick one box per row*Strongly
disagree

Disagree

Neither
/nor

Agree

Strongly
agree

a I intend to use public transport more than I do now to get to health facility appointments

☐₁☐₂☐₃☐₄☐₅

b I intend to walk more than I do now to health facility appointments

☐₁☐₂☐₃☐₄☐₅

c I intend to cycle more than I do now to health facility appointments

☐₁☐₂☐₃☐₄☐₅

C Car driving

This section is only for people who have driven a car in the past 12 months.

If you have not driven in the past 12 months, please go to section D.

C.1 How many cars are available to DRIVE for private use by YOU?

(please do not include any cars available as a member of car sharing club)

Please tick ONE box only

☐ 0 ☐ 1 ☐ 2 ☐ 3 or more

C.2 Roughly how many kilometres did you DRIVE in the past 12 months in total using all the cars available to you?

Please tick ONE box only

None	< 3000 kms	3,001 -8,000 kms	8,001 -16,000 kms	16,001 -24,000 kms	24,001 -32,000 kms	32,001 -40,000 kms	> 40,000 kms
<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

C.3 Please say how much you agree / disagree with the following statements:

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a For most journeys, I would rather use the car than any other form of transport	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
b Driving gives me a way to express myself	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
c I am not interested in reducing my car use	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
d I would like to own a larger or faster car	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
e There are no realistic alternatives to most of the car journeys I make	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
f It is usually quicker by car than by public transport	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
g It is usually cheaper by car than by public transport	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
h Reducing my car use would make me feel good	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
i I have actively cut down my car use in the past year	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
j I have already cut down my car use as much as I can	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
k If I have to go somewhere, I tend to automatically go by car	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
l If I could, I would gladly do without a car	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
m I like to drive just for the fun of it	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
n I believe I am too dependent on the car	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
o I do not feel guilty when I use my car for short journeys	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
p Traffic problems will reduce if I drive less	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
q By reducing my car use, I can help stop climate change	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
r Driving can be stressful sometimes	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
s I intend to reduce my current level of car use in the next 12 months	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
t I intend to reduce the amount I use the car to health centre appointments	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Now please go to section E.

D For those people who have not driven a car in the past 12 months

This section is only for people who have not driven a car in the past 12 months. Otherwise, please go to section E.

D.1 Please tell us why you have not driven a car in the past 12 months?

Tick ALL that apply

- a ☐ I do not have a driving licence
- b ☐ Cost/it's too expensive
- c ☐ I don't like to drive
- d ☐ I am too old/unfit/unwell
- e ☐ I am temporarily without a car
- f ☐ I have given it up because of environmental issues
- g ☐ I have no need to drive as public transport/walking/cycling are all adequate
- h ☐ I have no need to drive as I can be a passenger in other people's cars
- i ☐ I have nowhere to park a car
- j ☐ Owning a car is too much hassle
- k ☐ I am not the kind of person who drives a car
- l ☐ Other/none of the above

D.2 How likely are you to drive in the next 12 months?

Please tick ONE box only

- Very unlikely Fairly unlikely Neither/nor Fairly likely Very likely
- ☐ ☐ ☐ ☐ ☐

Now please go to section E

E Attitudes to different modes of transport

E.1 In general, how much do you like travelling by the following types of transport?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
I like travelling by					
a car as a driver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b car as a passenger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c local bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d underground/tube	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e bicycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f walking (to/from a destination)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g train	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.2 To what extent do you agree with the following statements about CAR USE?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a A car provides status and prestige to its owner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b People should be allowed to use their cars as much as they like	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c I think owning a car is a sign of success	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.2 continued

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
d It is important to reduce the number of cars on the road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e You can judge a person by the car they drive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Car use reduces quality of life in cities due to traffic noise and odour nuisance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g A high level of car use leads to an unhealthy lifestyle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h People who do not own a car are at a disadvantage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i I would like to travel by car more often than I have recently	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j Travelling by car is expensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.3 To what extent do you agree with the following statements about CYCLING?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a I am not the kind of person who rides a bicycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b In general, I would rather cycle than use the bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Cycling provides freedom and flexibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d I feel I should cycle more to keep fit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Cycling can be the quickest way to travel around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Cycling is a very healthy way to travel around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g I tend not to cycle because I am not fit enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Cycling gives me a way to express myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i Cycling is dangerous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j I find cycling stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.4 To what extent do you agree with the following statements about WALKING?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a I am not the kind of person that likes to walk a lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b In general, I would rather walk than use the bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Walking provides freedom and flexibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d I feel I should walk more to keep fit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Walking can be the quickest way to travel for short journeys	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Walking is a very healthy way to travel around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g I tend not to walk much because I am not fit enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.5 To what extent do you agree with the following statements about travelling by BUS?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a I am not the kind of person to use the bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b In general, I would rather go by bus than cycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c There are many problems with using the bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d I think that successful people tend to travel by car rather than by bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Buses can be the quickest way to get around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f I find travelling by bus is expensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g I find travelling by bus stressful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E.6 To what extent do you agree with the following statements about CONGESTION AND THE ENVIRONMENT?

Please tick one box per row

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a Traffic congestion is a problem in my local area	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b It is important to build more roads to reduce congestion	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c I feel a moral obligation to help solve my town/ city's traffic problems	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d Being environmentally responsible is important to me as a person	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e What I do personally can make a real difference to climate change	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f New car technology will be enough to solve the environmental problems caused by car use	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g I feel a moral obligation to reduce the emission of greenhouse gases	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h Environmental threats such as global warming have been exaggerated	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

F Your journey to your health facility

F.1 If you had to, how easy/difficult is it for you to use the following types of transport to travel to the health facility you visit the most frequently?

Please tick one box per row

	Very difficult	Quite difficult	Neither /nor	Quite easy	Very easy
a Car as a driver	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b Car as a passenger	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c Local bus	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d Tube/underground	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e Bicycle	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f Walking	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g Scooter/motorcycle	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h Train	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

F.2 Imagine you had no constraints. Would you prefer to travel to your health facility appointments by

Please tick one box per row

	No preference	Weak preference	Neither /nor	Some preference	Strong preference
a Car as a driver	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b Car as a passenger	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c Local bus	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d Tram/metro/train	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e Bicycle	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f Walking	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g Scooter/motorcycle	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h Train	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

F.3 Thinking about your MAIN mode of travel to your health facility, please rate your journey according to the following?

Please tick one box per row

I feel that my journey to the health facility is generally

	Strongly disagree	Disagree	Neither /nor	Agree	Strongly agree
a Stressful	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b Good value for money	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c Good for the environment	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d Safe	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e Flexible	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f Reliable	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g Allows a productive use of time	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h Comfortable	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i Sociable	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j Is little effort	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k Healthy	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l Quick	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
m Convenient	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

F.4 How satisfied are you with your current journey to your health facility?

Please tick ONE box only

Very unsatisfied	Fairly unsatisfied	Neither /nor	Fairly satisfied	Very satisfied
<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

F.5 Are you aware of any actions or initiatives being taken at your health facility to encourage more sustainable travel patterns?

☐₁ Yes ☐₂ No

If Yes, please write in all of the actions or initiatives that you are aware of

F.6 Please say how effective the following things would be to influence the way you travel by different modes to your health facility:

Please tick one box per row

	Totally ineffective	Quite ineffective	Neither /nor	Quite effective	Very effective
a Cheaper fares on public transport	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b Up to date travel information on bus routes, times and fares	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c More frequent/reliable bus services	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d Less crowded bus services	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e Improved cycle paths	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f Improved pedestrian links	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g Seeing other health centre visitors using modes other than the car more often	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h Parking restrictions at the health centre	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

G About you and your household

G.1 Are you

☐ Male ☐ Female

G.2 How old are you?

Please tick ONE box only

☐ 16-18 years ☐ 45-54 years
☐ 18-24 years ☐ 55-64 years
☐ 25-34 years ☐ 65-74 years
☐ 35-44 years ☐ 75 or over

G.3 How old were you when you left full time education?

Please tick ONE box only

☐ 15 years old or less
☐ 16-19 years old
☐ 20+ years old
☐ I am still studying

G.4 Are you

☐ Employed/self-employed full time ☐ Unwaged (eg house carer)
☐ Employed/self-employed part time ☐ Full time student at college or university
☐ Unemployed/seeking work ☐ Long term sick/disabled
☐ Retired

G.5 How many people live in your household? (please fill in the exact number for each)

a Children aged under 2 years _____
 b Children aged 2-16 years _____
 c Adults aged 16-65 _____
 d Adults aged over 65 years _____

G.6 Do you have any kind of disability or long standing health problem that affects your travel options?

☐ Yes ☐ No

G.7 Would you like to be entered into our prize draw?

☐ Yes ☐ No

G.8 Would you be prepared to be contacted by us in the future if we are conducting further research on these issues?

This may be up to two years in the future

☐ Yes ☐ No

G.9 If yes to EITHER of the above questions, please could we have your contact details?

Your details will ONLY be used for the purposes of this research

- a Name _____
- b Address _____

- c Postcode _____
- d Email address _____

G.10 If No to both of the questions above, would you be prepared to give us your home postcode anyway in order that we can use it to work out the walking and car routes which people use?

Your response will be kept strictly anonymous and will only be used for the purposes of this research.

What is your home postcode _____

Source:

SEGMENT: London Borough of Hounslow, Travel to Health Care Facilities Questionnaire, Retrieved Dec 5, 2016 at [http://www.segmentproject.eu/Hounslow/Segment.nsf/Files/SFF-58/\\$file/Healthcare%20Questionnaire.pdf](http://www.segmentproject.eu/Hounslow/Segment.nsf/Files/SFF-58/$file/Healthcare%20Questionnaire.pdf)

APPENDIX B

ADDITIONAL QUESTIONS

To drivers only:

Please say how much you agree/disagree with the following statements:

I would like to own a larger car/truck/van

I would like to own a faster car/truck/van

I intend to reduce the amount I use the car/truck/van to work

My auto expenses are too high (e.g. insurance, maintenance)

Driving is much safer than transit

Driving is much safer than bicycling

To all participants:

Please say how much you agree/disagree with the following statements:

Finding a parking space at work is difficult

I do NOT need to have a car/truck/van

I would rather be a carpool passenger to read, use smartphones, or sleep on the way to work

I had a bad experience as a carpool passenger in the past

In general, I would rather carpool than ride the bus or train

I worry about being stranded at work in the event of an emergency if I don't drive to work

I do NOT know anyone with whom to carpool

I am NOT the kind of person to share a ride in a carpool

I would like to ride with a friend or coworker to work

I do NOT feel safe riding with others

My employer reimburses bicycle commuting expenses

APPENDIX C

SUMMARIES OF STATISTICAL METHODS

Dendrogram

At the bottom of a dendrogram are the leaves; each leaf represents one participant. As we move up the tree, some leaves that are similar to each other are fused into branches. As we move higher up the tree, branches themselves fuse with leaves or other branches. The lower height a fusion occurs, the more similar the groups of observations are to each other. Observations that fuse higher on the tree are quite different. For any two observations, the height where branches containing those two observations are first used indicates how different the two observations are. From a dendrogram, we can identify the clusters by making a horizontal cut across the tree.

Elbow plot

This is a plot of variance within groups against the number of groups. For clustering analysis, it is desirable that each cluster has small variance among its members. As we increase the number of clusters, within-group variance will monotonically decrease. One should choose a number of clusters so that adding another cluster does not produce much lower within-group variance. At some point in an Elbow plot, the marginal decrease will drop, making an elbow-shaped angle in the graph. The optimal number of clusters is chosen at this point. This elbow may not always be unambiguously identified (Ketchen & Shook, 1996).

AIC/BIC scores

Akaike information criterion (AIC) and Bayesian information criterion (BIC) are measures of the information lost when a given model is used to represent the process that generates the data while penalizing for complexity. In clustering analysis, clusters are assumed to follow a multivariate Gaussian distribution whose complexity increases as the number of clusters increases. We would like to choose the number of clusters so that BIC or AIC is minimized.

APPENDIX D

DISCRIMINATE FUNCTIONS FOR NON-DRIVERS

Parameters (b_i)	Group 1	Group 2	Group 3
Constant	-51.16	-65.93	-45.01
I am NOT the kind of person to use public transportation	1.74	0.43	2.29
My employer reimburses bicycle commuting expenses	3.46	2.02	2.80
I like traveling by subway or elevated	1.78	1.82	0.52
I do NOT need to have a car/truck/van	2.82	3.74	1.94
I like traveling by taxicab	1.63	1.38	0.49
Traffic congestion is a problem in my local area	1.42	2.50	2.48
I have no need to drive as public transport/walking/cycling are all adequate	1.35	4.94	1.74
In general, I would rather walk than use the bus	2.64	3.78	2.73
I like traveling by ferryboat	3.26	4.09	2.50
I feel a moral obligation to reduce the emission of greenhouse gases	3.93	5.18	3.69
I like traveling by local bus or trolley bus	3.21	4.01	2.73
There are many problems with using public transportation	2.48	2.35	3.51
I do NOT know anyone with whom to carpool	2.49	3.09	3.23
Walking can be the quickest way to travel for short journeys	1.80	1.91	1.01
I had a bad experience as a carpool passenger in the past	-0.22	-1.15	-0.55
Finding a parking space at work is difficult	1.34	1.40	0.56

Given a new record of answer to these questions (X_i 's), we predict group membership as follows. For each group, score is calculated as $\sum(b_i X_i)$, where b_i 's are coefficients given in the table. The group with the highest score is chosen.

APPENDIX E

DISCRIMINATE FUNCTIONS FOR DRIVERS

Parameters (b_i)	Group 1	Group 2	Group 3	Group 4
Constant	-68.57	-60.34	-78.15	-74.51
I like traveling by bicycle	2.91	2.55	3.67	3.56
Reducing my car/truck/van use would make me feel good	3.60	2.69	4.11	3.47
I like traveling by streetcar or trolley car	2.19	1.08	2.36	1.71
I feel a moral obligation to reduce the emission of greenhouse gases	5.40	4.49	6.24	5.41
I am NOT the kind of person to use public transportation	2.45	3.14	1.99	2.90
I am NOT the kind of person who rides a bicycle	4.24	4.11	3.47	3.44
Driving gives me a way to express myself	2.33	2.75	2.09	2.87
I would rather be a carpool passenger to read, use smartphones, or sleep on the way to work	1.63	0.94	2.13	1.78
I like traveling by walking (to/from destination)	3.38	2.70	3.84	3.73
In general, I would rather bicycle than use the bus	2.06	2.14	2.80	2.86
If I could, I would gladly do without a car/truck/van	1.62	1.00	2.03	1.27
I like traveling by ferryboat	2.27	1.28	2.68	2.15
People should be allowed to use their cars/trucks/vans as much as they like	5.72	6.43	5.66	6.42
Environmental threats such as global warming have been exaggerated	2.20	2.59	1.68	2.20
I tend NOT to walk much because I am not fit enough	2.11	1.68	1.58	1.73

Given a new record of answer to these questions (X_i 's), we predict group membership as follows. For each group, score is calculated as $\sum(b_i X_i)$, where b_i 's are coefficients given in the table. The group with the highest score is chosen.



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