Modeling travel behavior by the structural relationships between lifestyle, built environment and non-working trips

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A B S T R A C T

In the context of sustainable urban transport in developing countries, individuals’ travel behavior faces multiple factors which influence their mobility patterns. Recognizing these factors could be a favorable method to organize more regular and sustainable trip patterns. This study aims to identify the less well-known lifestyle along with more popular built environment as the main factors which shape travel behaviors. Employing data from 900 respondents of 22 urban areas in city of Shiraz, Iran, this paper explores travel behaviors as non-working trip frequencies by different modes. Results of structural equation model indicate a strong significant effect of individual’s lifestyle patterns on their non-working trips. However, built environment impact on travel behavior is small compared to lifestyle. Besides, other variables such as travel attitudes and socio-economic factors stay crucial in the mode choice selection. These findings indicate the necessity of regarding lifestyle orientations in travel studies as well as objective factors such as land use attributes.

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1. Introduction

In recent decades, Iran like many developing countries, have encountered the growth of usage private vehicles as a dominant pattern of trips in urban areas. Reports suggest that, Iran is the second-largest oil-consuming country in the Middle East and Iranian domestic oil consumption is mainly diesel, gasoline, and fuel oil. In 2013, FGE estimates that Iran imported almost 17,000 bbl/d of petroleum products, of which roughly 85% was gasoline (EIA, 2014). The daily trips by cars are among important sources of energy consumption and air pollution. Among the world’s top ten most polluted cities, four are in Iran, according to data based on a 2013 World Health Organization index. Automobile use in large cities of Iran has extended in the past years according to transportation ministry estimates (The guardian, 2014). To manage this increasing energy consumption, we should first recognize the factors which shape individuals travel patterns and the reasons behind vast car use.

There is a huge body of researches concerned with the impact of built environment indicators (e.g. high density, mixed-land use, design and accessibility) on the individual’s travel behavior (e.g., Crane, 2000; Ewing and Cervero, 2001; Handy et al., 2005; Stead and Marshall, 2001; Cervero and Murakami, 2010). Accordingly, multiple studies investigate the factors which influence urban trip patterns in Iranian cities by considering demographic and land use characteristics (e.g. Etminani Ghasrodashti, 2009; Soltani and Esmaeili, 2011; Masoumi, 2013). Cited studies which have been conducted in cities with high traffic jam, indicate a strong impact of demographic characteristics, in contrast to urban form and built environment, in determining individual mobility patterns (Soltani and Etminani Ghasrodashti, 2010: 151). The results manifest that
apart from urban form characteristics, some hidden factors play a crucial role in shaping the mobility patterns in Iranian cities; these factors can be derived from culture, lifestyle, individuals’ attitudes and beliefs toward mobility modes.

In recent years attention to the impacts of subjective factors such as attitudes, beliefs, personality and also lifestyle on travel patterns has significantly increased (Mokhtarian and Salomon, 2001; Bagley and Mokhtarian, 2002; Anable and Gatersleben, 2005; Ory and Mokhtarian, 2009; Van Acker et al., 2014). These studies have tried to answer the question that how the subjective factors such as lifestyle and attitudes along with land use attributes could influence travel behavior. Although they argue the lifestyle as the patterns of leisure and consumption, in most of studies it has limited to how people express their social position through behavioral patterns. In contrast, in present study the lifestyle is explored as the pattern of consumption and leisure activities by different modes of mobility. Besides, built environment factors along with socio-economic characteristics and attitudes toward travel and residential neighborhood have been taken into account as other factors affect travel behavior.

The paper is organized as follows. Section 2 reviews the literature on the interaction of travel behavior, built environment and lifestyle in brief. Section 3 expresses the data used in the study. Section 4 indicates the empirical results. The final section concludes the paper.

2. Literature review

Since 1970s, activity-based modeling led to offer more realistic representation in individuals travel behaviors compared to traditional trip-based travel demand models. Activity-based modeling predicts travel behaviors through differences in household factors (such as socio demographics and life stage) and non-household factors (built environment, socio environment, travel policies).

In this regard, vast studies argue that travel behaviors has notably influenced by built environment via different variables. Some research have explored the impacts of land use attributes on motorized and non-motorized trip frequencies (e.g., Handy, 1993; Boarnet and Sarmiento, 1998; Boarnet and Crane, 2001; Chatman, 2008); while others have been conducted on vehicle mile traveled (Chatman, 2008). Moreover, to decrease methodological limitations, some studies have tried to search the impact of built environment on individual mode choice (e.g., Cervero, 2002; Chatman, 2003; Ewing et al., 2004; Frank et al., 2008; Lee et al., 2014). On the other hand, built environment factors are undoubtedly one of the most heavily research subject in travel studies and the most cited factors of land use are named as Ds. The original “3Ds” created by Cervero and Kockelman (1997), are density, diversity, and design, followed later by destination accessibility and distance to transit (Ewing and Cervero, 2001, 2010; Ewing et al., 2009). However, most of research have simplified travel studies and suffer from ignoring the subjective factors which influence individual trip patterns.

Travel behavior can also explain by social expectations about behavior such as norms, values, beliefs, attitudes and finally lifestyle. In this regard, two leading theories consist of value-belief-norm theory (Stern et al., 1999) and the theory of planned behavior (Ajzen, 1991; Fishbein and Ajzen, 1972) support this fact that perceived social norms are considered to be another possible determinant of behavior. Therefore, a hierarchy of decisions is made by travelers where decisions at a higher level (such as lifestyle) determine the scope of actions at lower levels (such as travel behavior).

The notion of lifestyle in transport studies was introduced by 1970s. At the early stage, lifestyle concept was defined as behavioral responses in terms of socio-economic differences, personal and social actions (Reichman, 1977). Using this definition, some travel studies tried to investigate the impact of lifestyle on travel patterns, but in fact they just refer the lifestyle to some objective characteristics such as stage of life or household composition (e.g., Salomon and Ben-Akiva, 1983; Cooper et al., 2001; Hildebrand, 2003). Moreover, some studies indicate that households with similar socio-economic attributes do not travel in similar patterns (van Wee, 2002; Mokhtarian and Cao, 2008). This disparities in travel patterns among individuals originate from various lifestyles. So, considering the lifestyle just as observable behaviors result from socio-economic differences between groups may not clearly explain the trip behaviors.

In another definition, lifestyle is behavioral patterns which derived from underlying opinions and orientations, including beliefs, interests and attitudes (Kitamura, 2009). Therefore, in some travel studies lifestyle has referred to individual’s attitudes toward work, family, money, status, and the value of time. For example, in order to determine the subjective factors which influence travel demand, Collantes and Mokhtarian (2007) introduced lifestyle groups such as status seeker, workaholic, family/community-oriented and frustrated. They found that, Individuals with a family-oriented lifestyle as well as individuals with a frustrated lifestyle frequently used their car for short-distance trips, family-oriented lifestyle was related with fewer long-distance leisure trips and also, workaholics travel significantly fewer short distance as well as long-distance trips for leisure purposes.

So, individuals indicate their social situation via specific patterns in consumption and leisure. Therefore, some studies focus on lifestyle expressions which are observable patterns of behaviors and reflect someone’s lifestyle. Using this definition of lifestyle, in an empirical study conducted by Scheiner (2010) in order to modeling trip distance traveled, lifestyle data was collected as leisure preferences, values and life aims, esthetic taste and frequency of social contacts. The results of the study indicated that lifestyle has the strongest impact on leisure trip distances.

Similarly, Van Acker et al. (2014) in a travel study utilized holiday aspects, literary interests and leisure activities as the long-term lifestyle decisions to develop a modal choice model. She found that, car availability tends to be higher among respondents with a more active lifestyle.
This paper aims to contribute to both lifestyle and built environment debates by studying travel behavior as non-working travel amounts in three different modes (car, public transit and walking/cycling trips). It also takes into consideration socio-economic characteristics as well as individual attitudes toward the travel and residential neighborhoods. Fig. 1 visualize how travel behavior can be explained by key variables and other factors. According to the special context of Iran, we consider the socio-economic attributes as the factor which influences travel behavior from the top of the hierarchy of decisions that are made by travelers. We assume that socio-economic attributes of individuals influence their attitudes toward travel and residential neighborhoods, and individual attitudes have effect on their lifestyle. In our conceptual model, socio-economic attributes also influence travel behavior directly and indirectly through built environment. Furthermore, built environment which influence travel behavior, can also impact on lifestyle of individuals. The reverse relations can also be possible, but not modeled in this study.

3. Methodology

3.1. Data and study area

The data used in this study was based on authors’ field survey and questionnaire and conducted in 22 study areas in the city of Shiraz, Iran in 2014 (see Fig. 2). Shiraz is the largest city in south of Iran with the population of 1.5 million, an area of 178,891 km² and 416,141 households (Shiraz Municipality, 2014). The sample was split between areas with various urban forms and socio-economic characteristics. Selecting the case studies in both urban and suburban areas allow us to examine the impact of residential neighborhood type on travel-related behaviors (Schwanen and Mokhtarian, 2005). The sampling method used in this study was Multi-Stage Cluster sampling. The priority of sampling was with areas lay within municipal regions. Then, according to the property prices, three ranges of price (high, medium, low) for land use were determined. Finally, with regards to the 160 traffic zones of Shiraz, the most important residential neighborhoods were selected as study areas in three ranges of land prices. Therefor, 22 study areas were selected as one-quarter mile buffer area, because buffer-based built environment measures are more reasonable and stringent than those considering TAZ-based variables in terms of explanatory power and statistical significance (Lee et al., 2014). Accordingly, to determine the sample size based on the population size, 900 heads of household contributed in vast face to face interviews and completing questionnaires about their socio-economic characteristics, travel behaviors, lifestyles, residential and travel attitudes. At the end of the survey, we geocoded the residential location in ArcGIS 10 and added objectively measured built environment characteristics of residential locations. The compositions of collected data are unique in Iran in so far that they let us to draw out a large variety of information in the level of individuals.

Table 1 displays some key socio-economic characteristics of 900 respondents. This table reveals that people between the 41–64 years old and full time workers have the most observations. As the monthly income has changed from rail to dollar, the real value of income toward the cost of living in a developing country has not shown in this table.

![Conceptual model of travel behavior](image-url)
3.2. Travel behavior

As discussed in Section 2, in this paper travel behavior has explored as individuals’ non-working trips. The most common travel measures are trip frequency, trip length, mode choice, and VMT (Ewing and Cervero, 2001). Hence, in this study both of trip frequency and mode choice have been modeled as the travel outcome. Frequency of home-based non-working trips is the measure of travel behavior in our model. Respondents were asked to report the number of their non-working trips to different destinations in a typical week by six travel modes; private car and alone, private car by others, bus, taxi, walking and biking. Each of these six variables is somehow related to another one, so they can be combined into three general non-working trip factors (principal axis factoring, 73.4% variance explained). These extracted factors are characterized by the following frequencies: 43% non-working trips by car, 27% by public transport and 30% walking/biking trips.

3.3. Lifestyle

The particular focus of this paper is the impact of lifestyle on travel behavior. Recent travel behavior studies mainly use the behavioral patterns of activity and time use, especially in the field of leisure, as the lifestyle measurements (Van Acker et al., 2014). However, the past travel behavior surveys generally lack information on the lifestyles which result from patterns of activities by different means of mobility. This is the distinction between current study and others. Lifestyles are presented in the data using two main fields: leisure and consumption activities by three modes of travel (private car, public transport and walking/cycling). Since lifestyles influenced by other factors like economic, cultural and living status dimensions (Ganzeboom, 1988), we tried to choose activities which include various economic and cultural conditions. In general, the wealthier, knowledge- and education-oriented, democratic and technologically evolved a society is, the more lifestyles are created in it that synchronically coexist along each other. In less developed societies four basics social fields of...
economics, politics, culture and religion are more tied to each other and closely connected. So, it follows that societies in which all four discourses are influencing each other directly produce on average fewer different lifestyles (Benedikter et al., 2011).

The survey included a list of 17 leisure interests and shopping-service activities. Respondents had to indicate how often they monthly refer to different places for these activities in a six-point Likert-type answer scales from ‘never’ to ‘more than five times per week’. Inquiry about these activities performed three times separately according to the place of each activity; inside and outside the neighborhood; and based on the various modes of transport.

Overall trip frequency to each destination was calculated by summing the individuals’ trip frequencies by three different travel modes through an indicator (from 0 to 20) across 17 leisure and shopping-services destinations and then the overall frequencies have changed to the six-point Likert-type answer scales. Responses on these survey items were factor analyzed in SPSS 22. In the factor analysis, the number of factors was determined based on the interpretability of factors, combined with interpretation of the scree plot and all eigenvalues larger than one.

These 17 types of leisure interests and shopping-service activities were factor analyzed (maximum likelihood, promax rotation, 53.3% variance explained, KMO = 0.879) into four underlying dimensions as: modern-oriented, traditional-oriented, consumer-oriented and education-oriented lifestyles. As it has shown in Table 2, in this study modern-oriented lifestyle refers to leisure activities such as going to a club for exercise, going to cinema and theater, and going to restaurant and coffee shops. Modern-oriented lifestyle which is linked to contemporary technology, often associated with more modernity and less religious-traditional approaches. Traditional-oriented lifestyle here is related to the leisure activities that are mostly shaped on modern life patterns. Modern-oriented lifestyle which is linked to contemporary technology, often associated with more modernity and less religious-traditional approaches. Traditional-oriented lifestyle here is related to the leisure activities that are based on simple and routine patterns of individuals’ life and religious terms such as going to park and green spaces, visiting relatives and attend in religious ceremonies. Consumer-oriented lifestyle stem from shopping-service activities which are primarily and weekly needed by individuals such as going to service providers or food and cloth stores. Education-oriented lifestyle is count for training activities which individuals have performed to promote their knowledge or professional expertise.

3.4. Built environment

Using information from various land use databases (ArcGIS 10), we calculated several spatial characteristics of the built environment in ¼ miles buffer areas. The built environment characteristics include diversity measure (entropy index), design measures (street density, internal connectivity), density measures (population density, residential density, job density) and accessibility measures (distance from home to closest bus station and closest intersection). All of these various measures were computed at trip origins by utilizing the parcel-based land use data and GIS technique. Hence, it is possible to evaluate the impacts of built environment of buffer areas on home-based non-working trips.

However, these land use characteristics can be related to each other (a place with high job density is a diverse place too). In order to display the structure among built environment measures, we conducted a factor analysis (principal axis factoring, 64.4% variance explained, see Table 3) which revealed three factors: spatial distribution, density and local accessibility to transit.
### 3.5. Other key variables

This paper investigates subjective as well as objective influences on travel behavior, and it particularly emphasizes on the effects of lifestyle and built environment. Individual attitudes can influence decision-making indirectly and irrationally (Ajzen, 2001). Some studies have argued the importance of individual attitudes impacts on travel behavior by investigating people's travel likes and dislikes, their opinions about environmental issues, their views about commute benefits, and their sense about travel freedom and travel stress (Mokhtarian et al., 2001; Ory and Mokhtarian, 2009). The survey contained 13 statements about individual's attitudes toward travel. Respondents were asked to state their opinions about each statement on a five-point ordinal scale ranging from 'strongly disagree' to 'strongly agree' according to variables that influence their beliefs about travel.

These statements were then factor analyzed (principal axis factoring, promax rotation, 58.4% variance explained, KMO = 0.720) into five main factors: physical-oriented, time management, pro-environmental, individualist and economic–political attitudes (Table 4).

Since previous travel studies on lifestyle examine individuals attitudes and preferences toward their residential neighborhood (see, e.g., Bagely and Mokhtarian, 2001; Van Acker et al., 2014), the survey also includes 14 statements on attitudes toward residential neighborhoods. Individuals were asked to indicate their preferences about residential areas if they were looking for a new place to live (even if they were not intending about moving) on a five-point ordinal scale ranging from 'unimportant' to 'very important'. By using factor analysis (principal axis factoring, promax rotation, 51.4% variance explained, KMO = 0.814), three main factors were extracted for residential attitudes: comfort, social cohesion and traffic resistance (Table 5).

Our survey also supported data on key objective variables such as socio-demographic characteristics. A factor analysis of socio-demographic characteristics (principal axis factoring, 77.7% variance explained, see Table 6) resulted in three factors concludes: household composition (People above 18 and Number of employers in the family), financial position (Income and Number of private car in the family), profile (age of respondent). These three factors have been addressed in models as socio-economic factors.
4. Structural equation model

In this part, the variables illustrated in Section 3 have been entered as input for the evaluating of structural equation model by the software package Amos 22. Using SEM in transport studies has more advantages toward single equation models. It allows the researcher to evaluate the effect of variables simultaneously (Hoyle, 2012). The conceptual model of the
paper implies multiple relationships between lifestyle, built environment and travel behavior variables. So, in SEM models one variable that is an endogenous variable in one set of the relationships, can be an exogenous variable in another equation at the same time.

4.1. Estimation methods

The discrepancy between the population moments and the moments implied by a model depends not only on the model but also on the estimation method. To estimate the models, a maximum likelihood (ML) method has been used. This method reveals that to what extent the observed variances and covariance between measures can be explained by the model. Using ML estimation of an SEM needs the normal distribution of endogenous variables (Harrington, 2009). Since some key variables in this study (e.g., lifestyles and attitudes) are categorical, great consideration has been taken in the model estimation. Amos 22.0 performs Bayesian model fitting for ordered-categorical data. The other three alternative methods have been used to estimate SEM models include: Asymptotically distribution-free (ADF), generalized least squares (GLS), and un-weighted least squares (ULS). ADF method works better in estimation of standard errors and does not desire normal data. Each of these methods which have their own merits and demerits, demonstrate relatively constant results and lead to increasing our confidence to model estimation. Moreover, to indicate the quality of model specification (compare the covariance matrix of observed variables of population with sample) some fitting indices have been used. The \( \chi^2 \)-statistics test is an appropriate fitting index, although it is almost significant in large sample sizes (Iacobucci, 2009). Hence, other indices such as \( \chi^2 \) test value divided by the model degrees of freedom, normed fit index (NFI), comparative fit index (CFI) and root-mean square error of approximation (RMSEA) have been employed in this study. Table 7 indicates the brief summary of goodness-of-fit based on estimation methods for SEM model on travel behavior. These values compare well to standard values which have been showed in the table, where the \( \chi^2/\text{df} \) value is about 2, the NFI value is 0.99, the of CFI is 0.97 and the RMSEA average value is 0.067.

4.2. Model results

After specifying the key variables and estimation methods, in this part the modeling results have been discussed. We first consider some interrelations examined in the conceptual model of the study, afterward the total effects of key variables on non-working trips will be explained. Other interrelations examined in the model framework, such as effects of socio-economic factors on built environment and attitudes, are excluded from interpretation due to lack of space. In order to realize direct and indirect relationships between all variables, both significant and insignificant total effects will be reported in SEM tables. Tables 8 and 9 summarize standardized total effects of SEM model and report significant effects between variables.

4.2.1. Interrelations between lifestyle and other variables

In this study it has assumed that lifestyle which impact travel behavior, influence by other variables like socio-economic attributes, attitudes and built environment. Accordingly, SEM model on travel behavior, consider the impacts of interrelations on lifestyle too. In the early theoretical discussions on the definition of lifestyle, socio-economic and demographic attributes considered as the main determinants of lifestyle (Ganzeboom, 1988; Kitamura, 1988). In this paper socio-economic factors are still a crucial determinant of individuals’ lifestyle. It can be observed from Table 8 that one of the most important influences of socio-economic factors is the negative impact of profile, on MOL. It seems that elderly people were less modern-oriented. In contrast, employees in the family, number of peoples above 18, car ownership and monthly income have a positive association with MOL. Also, it is clear that age of respondents were negatively associated with EOL.

Through travel attitudes, pro-environment attitude (such as individuals who were willing to reduce their car usage) have indicated a direct relationship with both MOL and TOL. Nonetheless, people with traditional lifestyle were more likely to be environment friendly. Individualist attitude (such as people who liked to travel alone by their private car), has a significant negative impact on TOL and a positive impact on COL. Moreover, economic–political attitude (such as people who agree with increasing the fuel price) has showed a strong positive impact on TOL. So it reveals that individuals’ travel attitudes have affected on their lifestyle.

Among the residential attitudes, social cohesion positively influence on TOL. This result can be rises from the fact that respondents who sought social relationships in a neighborhood were more willing to have traditional leisure activities such as going to parks or religious ceremonies. This finding could be the same but weaker for traffic resistance attitude toward a residential neighborhood. Respondents who were preferred to live in a neighborhood with suitable sidewalks and low traffic,

| Table 7 |
| Goodness-of-fit measures. |
|---|---|---|---|---|---|
| Model standard value | \( \chi^2/\text{df} \), \( \rho \) | \( \chi^2/\text{df} < 2 \) | NFI > 0.95 | CFI > 0.95 | RMSEA < 0.1 |
| Model-based value | 273.24, 138, 0.000 | 1.97 | 0.99 | 0.97 | 0.067 |
had traditional-oriented lifestyle. Besides, comfort attitude have indicated negative association with MOL, COL and EOL. It seems that in the case of this residential attitude, respondents’ preferences do not necessarily follow their lifestyle.

Some of the built environment factors are also associated to lifestyle. Spatial distribution positively impacts on MOL. It means that Mixed-land uses, street design and connectivity in residential neighborhood were the factors which lead people to have modern-oriented lifestyle. Interestingly, density has negatively influenced on COL. Respondents who reside in dense

<table>
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<th>Table 8</th>
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<td>The total standardized interrelation effects on lifestyles.</td>
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</tbody>
</table>

| Effect of on . . . | Lifestyles |
|---|---|---|---|---|
| | MOL | TOL | COL | EOL |
| Socio-economic factors | | | | |
| Household composition | 0.151*** | 0.053 | 0.068 | −0.021 |
| Financial position | 0.150*** | −0.032 | 0.045 | 0.039 |
| Profile | −0.340*** | 0.001 | 0.041 | −0.134*** |
| Travel attitudes | | | | |
| Physical-oriented | 0.039 | 0.034 | 0.084* | −0.012 |
| Time management | 0.021 | 0.013 | 0.044 | 0.006 |
| Pro-environment | 0.079* | 0.128*** | 0.039 | 0.067 |
| Individualist | 0.056 | −0.075 | 0.097* | 0.014 |
| Economic–political | −0.05 | 0.124*** | 0.012 | 0.061 |
| Residential attitudes | | | | |
| Comfort | −0.090* | 0.01 | −0.085* | −0.105*** |
| Social cohesion | 0.067 | 0.153*** | −0.012 | −0.005 |
| Traffic resistance | 0.006 | 0.080 | 0.002 | −0.018 |
| Built environment | | | | |
| Spatial distribution | 0.103* | 0.068 | 0.012 | −0.031 |
| Density | −0.058 | 0.032 | −0.095** | −0.043 |
| Local accessibility to transit | 0.012 | 0.015 | 0.1 | −0.009 |

Note:  
* Significant α = 0.1.  
** Significant α = 0.05.  
*** Significant α = 0.01.

<table>
<thead>
<tr>
<th>Table 9</th>
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<td>Total standardized effects on non-working trips.</td>
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<table>
<thead>
<tr>
<th>Effect of . . . on . . .</th>
<th>Non-working trips by car</th>
<th>Non-working trips by public transport</th>
<th>Non-working trips by walking/cycling</th>
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<tbody>
<tr>
<td>Lifestyle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOL</td>
<td>0.106***</td>
<td>0.009</td>
<td>−0.054</td>
</tr>
<tr>
<td>TOL</td>
<td>0.058</td>
<td>0.146***</td>
<td>0.205***</td>
</tr>
<tr>
<td>COL</td>
<td>0.102***</td>
<td>0.022</td>
<td>0.100***</td>
</tr>
<tr>
<td>EOL</td>
<td>0.015</td>
<td>0.160***</td>
<td>0.045</td>
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<tr>
<td>Travel attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical-oriented</td>
<td>0.067*</td>
<td>0.049</td>
<td>0.057</td>
</tr>
<tr>
<td>Time management</td>
<td>−0.025</td>
<td>0.058</td>
<td>0.029</td>
</tr>
<tr>
<td>Pro-environment</td>
<td>−0.161***</td>
<td>0.226***</td>
<td>0.117***</td>
</tr>
<tr>
<td>Individualist</td>
<td>0.083*</td>
<td>−0.025</td>
<td>−0.037</td>
</tr>
<tr>
<td>Economic–political</td>
<td>0.001</td>
<td>0.181***</td>
<td>0.160***</td>
</tr>
<tr>
<td>Residential attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfort</td>
<td>0.064*</td>
<td>−0.071*</td>
<td>−0.052</td>
</tr>
<tr>
<td>Social cohesion</td>
<td>−0.001</td>
<td>−0.021</td>
<td>0.067*</td>
</tr>
<tr>
<td>Traffic resistance</td>
<td>0.041</td>
<td>0.028</td>
<td>0.059</td>
</tr>
<tr>
<td>Built environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial distribution</td>
<td>−0.176***</td>
<td>0.013</td>
<td>0.024</td>
</tr>
<tr>
<td>Density</td>
<td>−0.065*</td>
<td>0.014</td>
<td>0.062*</td>
</tr>
<tr>
<td>Local accessibility to transit</td>
<td>0.024</td>
<td>0.0</td>
<td>−0.021</td>
</tr>
<tr>
<td>Socio-economic factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household composition</td>
<td>0.97*</td>
<td>0.076*</td>
<td>0.002</td>
</tr>
<tr>
<td>Financial position</td>
<td>0.191***</td>
<td>−0.174***</td>
<td>0.003</td>
</tr>
<tr>
<td>Profile</td>
<td>−0.017</td>
<td>−0.007</td>
<td>0.109**</td>
</tr>
</tbody>
</table>

Note:  
* Significant α = 0.1.  
** Significant α = 0.05.  
*** Significant α = 0.01.
neighborhoods were less willing to have a consumer-oriented lifestyle. On the other hand, these respondents have indicated more traditional-oriented lifestyle.

4.2.2. Effects of key variables on non-working trips

Table 9 indicates SEM model of non-working trips by three modes of transport based on our conceptual model. As mentioned in previous section, the model explores the impacts of key variables on non-working trips by controlling all interrelations on lifestyle. At the first row of Table 9, the impacts of lifestyle on non-working trip frequencies by different modes have been investigated. Lifestyle is among the most important determinants of non-working trips. It is clear from Table 9 that MOL and COL are positively related to number of non-working trips by car per week. It reveals respondents who were concerned about modern entertainments and people with more frequency of tours to shopping-service destinations, preferred to use their private car to do their activities. Non-working trips by transit were significantly related to TOL and EOL. Among these kinds of lifestyles, education-oriented respondents were more likely to use public transport in their daily trips. Moreover, non-working trips by walking/cycling were influenced by TOL and COL. It seems that individuals with traditional leisure activities were strongly eager about walking and cycling trips. Since COL in this study refers to consumption of goods or services which are primary and weekly needs of individuals such as shopping foods, cloths or using service providers like banks, this lifestyle was performed inside the borders of individuals’ neighborhood by walking/cycling and outside the neighborhood by private car. So, it can be concluded that COL refers to shopping-services activities with both short and long distances from home and it was associated with car and walking trips.

The association between travel attitudes and non-working trips by different modes has been noted in second row of Table 9. Non-working trips by car influenced by pro-environment attitudes. This travel attitude shows a significant negative impact on car trips. Respondents who were ready to decrease and alter their car use to sustainable modes were less likely to utilize private car in daily non-working trips. In spite of pro-environment attitude, physical-oriented and individualist attitudes were positively associated with car trips. It shows that respondents who expected more facilities in roads and extended highways and people who felt more comfortable in using their private car, were eventually more car users. In concern with non-working trips by public transport and walking–cycling, again pro-environmental and economic–political attitudes has known significantly. Both of these attitudes were positively related to using public transport and walking/cycling. It is clear that pro-environment attitudes were the most determinants of non-working trips.

Residential attitudes are slightly related to frequencies of non-working trips. Respondents who were prefer to live in a comfort neighborhood (e.g., green and open spaces, calm and clean residential area) used more private car and less public transport in their daily trips. Attitudes toward the residential neighborhood might change once the residential location is chosen (Van Acker et al., 2014), but in our model residential attitudes does not influenced by residential environment. We assumed residential attitudes are the preferences of individuals about a residential neighborhood which could impact on their travel behavior. This assumption only has been truly proved through social cohesion attitude; respondents who tended to have social cohesion in their neighborhood were more willing to do walking/cycling trips.

The built environment factors seem to have less significant impacts on non-working trips. The most significant factor is spatial distribution. Respondents, who reside in diverse neighborhoods with well-connected and designed streets, were less likely to use private car for their weekly trips. This finding is compatible with the impact of diversity on travel behavior in previous studies results. Moreover, density in neighborhoods led to decrease of car use and increase in walking/cycling.

As we found from socio-economic factors, financial position have a positive effect on non-working trips by car and negative impact on public transport. It is clear that higher income and car ownership are responsible for more non-working trips by car and less tendency to use public transport.

Household composition which point to number of employees and people above 18 in the family, were related positively to both car and public transport. It is obvious that large families logically produce more non-working trips. In the case of walking–cycling trips, it is interested that elderly people were more willing to do their activities by this sustainable travel mode.

5. Conclusion

This paper has represented structural equation model of travel behavior emphasizing on subjective as well as objective determinants of non-working trips by three modes of transport. Using data collected from individual survey, structural relationships between lifestyle, built environment and non-working trips were studied. The results demonstrate that, lifestyle as a subjective factor which influenced by other variables such as attitudes, land use and socio-economic factors, could be a great determinant of non-working trips.

In this study, modern-oriented lifestyle (MOL) has significantly influence on individual’s car use. It implies that non-working trips by car markedly stem from respondent’s demand for leisure and entertainment activities which root in evolution of society to a new community with tendency to contribute in modern activities (Ecorys, 2008). So, respondents with modern lifestyle are expected to make frequently more car trips. In our study, this lifestyle which includes leisure activities such as going to a club for exercise, strolling in malls and shopping centers for fun or going to natural gardens, due to the long distances, people prefer to do them by private car. Although, unlike the study of Collantes and Mokhtarian (2007) which shows family-oriented lifestyle is related to more short distance trips by car, in our study modern-oriented lifestyle is
associated with long distance trips by car. Based on our studies, Consumption-oriented lifestyle is another determinant of non-working trips by cars. Although COL was associated with walking/cycling trips too, it should be considered that consumption pattern is an important factor of car usage. This finding could be due to the fact that Persian lifestyle is unsustainable in many ways and are based on overproduction and overconsumption; so it counts for repetitive car trips to shopping and service providers.

According to our findings, other two lifestyles (TOL and EOL) result in more non-working trips by sustainable modes such as public transport and walking/cycling. Traditional-oriented lifestyle which sharply was influenced by residential and travel attitudes, is among the most crucial determinants of non-working trips by walking/cycling. A possible justification behind this fact is that people with traditional-oriented lifestyle prefer to do leisure activities which require destinations close to their residential areas such as spending time in parks and green spaces or attending in religious ceremonies. So, it can be concluded that respondents’ willingness of walking changes inline with the distance of an activity from home; the further they travel, the less they walk (Susilo et al., 2012).

The contribution of built environment as an objective factor to travel behavior was founded significant but less important than lifestyle. Non-working trips by car tend to be lower in mixed-land use neighborhoods with well-designed streets which benefit from enough internal connectivity. This result is almost similar to findings of previous studies about the impact of design and diversity on mode choices (e.g. Handy, 1996; Cervero and Kockelman, 1997; Ewing and Cervero, 2001 and etc.). Compare to finding of past studies (Ewing and Cervero, 2001; Ewing et al., 2009; Zegras, 2007; Greenwald and Boarnet, 2001), in this paper density has a small but significant impact on car and walking trips, So, moderate density might lead to making trips by sustainable travel modes. Although, in contrast with lifestyle, the impacts of built environment on travel behavior is mainly weak.

Apart from lifestyle and built environment, other key variables like attitudes toward travel are recognized as travel behavior determinants. As we found for travel attitudes, pro-environment attitude is related to fewer car trips and more public transport and walking trips. In this study, individuals with more pro-environmental attitudes are more eager to use alternative modes of travel like public transport due to the better understanding of moral norms (Anable and Gatersleben, 2005).

Economic–political attitude which is referred to the individuals who were prepare to pay the tax for reducing negative consequences of car using and benefit from alternative modes, is directly related to public transport and walking trips. It reveals that pro-environmental solutions could decrease using of personal vehicle (Mokhtarian et al., 2001; Ory and Mokhtarian, 2009). Although, it should be pointed that the way individuals response to a policy which aimed to reduce car travel will depend on the value they allocate to travel utility and the desirability of other travel alternatives. On the other hand, it is found by the results that people gives positive and negative points to their car travels and alternative modes and they choose private vehicle when they found that the merits of car use for their travel is more than it’s demerits. So, respondents with physical-oriented and individualist attitudes feel that the advantageous of car use is more than related disadvantageous. This result has a clear policy implication toward car reduction: advanced and credible public transport systems encourage people to choose more sustainable travel modes. This approach operates on subjective aspect of individuals’ travel behaviors.

Contrary to past studies (Van Acker et al., 2014), in this research residential attitudes are slightly associated to travel behavior. Hence, it can be suggested that in our case study residential self-selection cannot be taken into account. Furthermore, travel behavior can also be regarded as expression of socio-economic factors. The results indicate that financial position which refers to income and number of cars in the household is associated with more non-working trips by car and less using of public transport.

The present paper seeks to achieve a behavioral approach in travel demand studies; the issue which has been less studied in Iran. Although this study is largely theoretical in what we are examining individual behavior beyond the prevalent travel demand models; the concept of our model can bring about practical suggestions. The notable influence of lifestyle on travel behavior is a new idea which can be regarded to promote travel demand strategies. Even though some studies have particularly mentioned the impact of 'subjective' lifestyle on travel behavior (e.g., Scheiner, 2010; Van Acker et al., 2014); more of them are conceptualized it mainly sociological terms with no presumptive connection to mobility. In this research lifestyle is measured in a way which is closely related to mobility and travel modes.

Since, the lifestyles are based on past and current consumption and production patterns and are tangled with people’s everyday choices and practices (Mont, 2007), shaping a sustainable lifestyle could be a complicated but favorable approach to achieve sustainable development. The findings of this study reveal this fact that recognizing the factors that influence individuals’ travel behavior in sustainable patterns requires a vast understanding of individuals’ lifestyle contexts and the systems within which different individuals’ lifestyles perform.

For instance, Consumer-oriented lifestyle is putting too much pressure on natural resources and imposing negative environmental, economic, social and health impacts. Besides, we have showed that this lifestyle is associated to private car use. So, recognizing consumption patterns and their resulting environmental and social impacts should be a major focus of policy planners. It is important to understand factors which drive from current individuals’ consumption and the methods that can alter their behaviors. Besides, modern-oriented lifestyle which is usually encountered with leisure trips by roads could be compatible with local options when it comes to traveling for pleasure and entertainments.

Although, it should be noted that car-oriented urbanization make it more difficult for people to have appropriate choices in their lifestyle patterns. It could be explained by exorbitance founding to large scale infrastructure systems, expanding
roads and large shopping malls in outskirts of cities that compel individuals to choose car-oriented and consumer-oriented lifestyles. Accordingly, the relationship between lifestyles and individuals trip patterns could be interfered through inappropriate urban planning. Mutual relation of lifestyle and transport planning is a major issue which should be regarded in future studies.

Moreover, it should keep in mind that this analysis is based on cross-section data of lifestyle which has its limitation. Further studies will need longitudinal data collection on lifestyle.

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References