



Assessing the effects of Children's independent mobility range and time

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ABSTRACT

Introduction: Previous studies provide evidence that associations between different factors and children's independent mobility (CIM). In these studies, no difference between CIM range and time whereas have been difference between CIM range and time and attitudes of children and parents. Roles of different factors, including gender haven't been also proven with CIM time and range. Therefore, sought to determine impact assessment of socio-demographic, built-environmental and perceptual characteristics with CIM time and range varied by sex.

Methods: The present study measured the longest distance of each child from house as CIM range (meter) and the CIM time was calculated based on the weekly activity programs of children (minutes). Research were conduct in Ilam, Iran and 102 twelve-to-fourteen-year-old children and their parent were studied (N = 204).

Results: Results of multivariate regression indicated that the CIM time was affected by parents' perception and equal between girls and boys (32 min) despite the fact that parents' fear of crime against girls was higher than boys'. The CIM range was highly dependent on built-environmental characteristics and boys' CIM range (216 m) was greater than girls' (159 m).

Conclusions: Vertical development of housing, parents' fear and sex differences were the most important factors in reducing the CIM.

1. Introduction

The children's independent mobility (CIM) is an important issue associated with the children life. Children's freedom to play in the neighborhood has developmental, health and social benefits (Badland and Oliver, 2012). The CIM has psychological benefits and allows children to communicate with friends and communities (Schoeppe et al., 2013). The interaction with the environment exposes children to the real experience of life. A large number of studies have also investigated the effect of CIM on increasing the children's physical activity (Page et al., 2010). In recent years, the reduction of CIM has been demonstrated by studies in different countries (Fyhri et al., 2011; McMillan, 2007). In the 20 years past, CIM have dropped from 130 to 72 min per week in New Zealand, but it has increased from 31 percent to 58 percent in those traveling to schools by car (Witten et al., 2013). The limitation of CIM has not only reduced the children's physical activity (Wen et al., 2009), but also adversely affected mental abilities, educational ability, personal-social skills, and children's friendliness (Rissotto and Tonucci, 2002).

In a study by Loebach and Gilliland (2014) although traveling far from home on occasion, 94.5% of children's time on average was spent within a short distance of home. Participants spent little of their free time in broader neighborhood settings. In research of Carver

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et al. (2014) CIM was restricted and only a third of children were allowed to roam more than 15 min from home alone. The number of accessible destination types in the neighborhood was positively associated with CIM range. The purpose of Schoeppe et al. (2016) study was to investigate adult attitudes on distances children should be allowed to travel to places and play in outdoor areas without adult supervision. 62% of 1293 adults would restrict children's independent travel to places <500 m from home, and 74% would restrict independent outdoor play <500 m from home. Also these models found the longest child distance of 250–1600 m from home (Harten and Olds, 2004). The most important message of previous studies was that 1) CIM takes place in an activity space around residential area, and 2) CIM time and CIM range have been reducing.

The residential area results from housing development policies that affect CIM (Moore, 1986; Leventhal and Newman, 2010). Furthermore, it is evident that there were relationships between CIM and build environment (Lin et al., 2017), disturbance in neighborhoods (Molnar et al., 2004), outdoor playing space, height residential buildings (Evans, 2003), number of housing floors and residential neighborhood density. Findings suggest that built environment policy that is focused on building footprint density could have a positive effect on CIM (Islam et al., 2014), whereas building density, measured as floor area ratio, had a negative association with CIM (Broberg et al., 2013a). Hayley et al. (2015) found the higher impact of social-demographic factors compared with housing characteristics of residential places.

Roles of social-demographic factors, including gender have been also proven (Carver et al., 2013; Alparone and Pacili 2012), but Broberg et al. (2013b) found no significant difference between genders. Children in Finland have one of the highest level of CIM, and therefore, research findings from this country may not be generalized to the other countries particularly which have lower level of CIM. The researchers have emphasized the impact of gender differences on CIM (Brown et al., 2008), but the impact of gender inequalities affecting the CIM should be further considered an important social factor (Islam et al., 2014). The male children have greater physical activity than girls (Johansson, 2006; Page et al., 2009). Studies have mentioned a positive relationship between boys with basic motor skills (Shams and Vameghi, 2018), physical activity (Martin et al., 2009), and independent mobility (O'Brien et al., 2000), compared to girls. Furthermore, Soleimani et al. (2018) studied a positive relationship between male and evolutionary delays in children. An important part of girls' limitations is not gender-based, but it is owing to the social and political contexts. Previous researches provides a valuable insight into the lack of attention to children in political geography (Skelton, 2010). The social contexts of modern cities do not have the same capabilities for male and female needs, and they have more male characteristics (Siadati and Majedi, 2015). This gender inequality has been more problematic on the CIM. Part of the gender inequality affecting children comes from parent attitudes.

Perceptive factors in children are associated with parent, such that parents' fear of CIM could be the most important factor limiting CIM. The road injury is the most important cause of child death in developed countries (UNICEF, 2001). Children's fear of cars, and children's and parents' sense of safety are among other perceptual factors considered in previous studies (Rudner, 2012; Giles-Corti et al., 2011). Also CIM is about characteristics such as peer support, parents' attitude to independent mobility, parents' and children's attitudes towards traffic, crimes against children and fear of strangers (Foster et al., 2014). Many results suggest a significant decline in parents' allowance for children's free games and independent travel to school (McDonald et al., 2011; Schoeppe et al., 2016; Shaw et al., 2013). Parents' attitudes affect the CIM time and range but there is no coherent research into the relationship between parent perception and CIM range/time.

Previous studies provide evidence that associations between environmental variables and CIM vary between boys and girls (Yan et al., 2010). Understanding whether built environmental, social and perceptual determinants influence CIM differently among boys and girls can be used to guide decisions related to programming options and the design and retrofitting of neighborhood. Results show that girls' physical activity was more strongly affected by social effects (eg, presence of other active children) whereas boys' physical activity was more strongly influenced by the availability of park facilities (Bocarro et al., 2015).

The previous studies have investigated roles of Sex differences and parent perceptions (Soleimani et al., 2018; Mackett et al., 2007; Kullman 2010), but there is no study into effects of Sex differences and parent/child perceptions on CIM. Like other cities of Iran, Ilam has a nine-year condition for girls in the field of citizens' religious beliefs affecting parent perceptions on presence of their children outdoors. Sex differences will be exacerbated when combined with parent perceptions on their children's activity. Therefore, there is a need for studies into relationships between Sex differences and parent perceptions of the significant reduction of girls' independent mobility compared to boys. There is no research on CIM not only in Ilam, but also in Iran. This research explored build environment and perceptual characteristics related to promote CIM varied by sex in Iran, Ilam. Bhosale et al. (2017) suggest the perceived degree of CIM is heavily dependent on mixed method. So in this research have been used two indicators 1) CIM time and 2) CIM range to evaluated CIM. Therefore, this study sought to determine impact assessment of social, environmental and perceptual characteristics with CIM time and range varied by sex.

2. Method

2.1. Data collection, survey process

A cross-sectional study was carried out to measure the relationships between independent variables and CIM range/time. The research was conducted in Ilam during the fall and winter of 2018. In this research targeted the age range of 12–14 years (first period high schools' children). Out of the 37 first period high school, 12 public schools, including 6 female and 6 male schools have been selected. With the help of the principals of these 12 schools, letters of request for consent were sent to students' parent. The consent form was signed by both child and parent. Finally, a total of 57 boys (55.9%), 45 girls (44.1%), and their parent cooperated in the study with a participation rate of 63% of all parent (N = 204). Surveys of each class lasted for 60–90 min, including a questionnaire for children and behavioral maps drawn for each subject by the help of a researcher (Table 1). The parent questionnaires with a letter of

cooperation have been sent individually to the parent through schools.

The internal consistency of Cronbach's alpha was used in this questionnaire. In the present study, eliminating some of the questions in order to integrate the questionnaire was inevitable. Questions 12, 18, 25, 29 and 35 were omitted. As a result, Cronbach's alpha coefficient was calculated for a total of 43 questions with software and the value was 0.834. Therefore, the questionnaire of this research has acceptable reliability.

2.2. Study context

The city of Ilam is one of the Micro cities of Iran located in the west of this country. With a population of 220,000 and area of 22,000 square kilometers in 2016. More specifically, 46,200 middle childhood children reside in this city (21%). This census shows that of each five persons one is in his or her middle childhood ([Center of Statistics, 2016](#)). The people of Ilam City are Kurd and they have the same sex geography for girls. Girls after puberty are less allowed by parent to play freely outside the home. Although, development in Ilam like macro cities in Iran is proceeding at a quick pace, as a result of fast population growth but social situation such as parent perceptions about CIM were haven't investigated in Iran and Ilam.

Ilam is undergoing transition from houses with yards to apartment buildings, similar to all provinces of Iran. This is more problematic in terms of the facilities for children. The children's use of the outdoor environment has reduced since such cities are being designed and planned for adults and children's play and recreational activities are restricted to indoor environment of their homes. Ilam is divided into two districts and there is no significant difference between the two regions in the child population and in building density. Houses within Ilam are a mix of two- and three-floor single-family houses and up to six-floor apartments. Different places are accessible to children in this city. The development of play areas, green spaces, utilities and access has not changed much since ten years ago but apartment building is developing quickly. Therefore, Ilam is a good case to examine the relation between changing environmental condition and CIM.

2.3. Measures

2.3.1. Places

As potentially meaningful places for children, functional, social, and emotional affordances were studied ([Broberg et al., 2013a](#)). So behavioral and perceptual places were studied based on previous studies. Behavioral places including friends' and relatives' houses, shops, bakeries, cafes, parks, educational institutions, libraries, sports clubs, gaming centers, and playgrounds. Perceptual places including allowed, forbidden, noisy, quiet, safe, dangerous, clean, dirty, libraries, beautiful and exciting. In this research behavioral and perceptual places were marked by child in map. The blue circle indicates behavioral places and the purple circle represents perceptual places ([Fig. 1](#)).

2.3.2. CIM range

Longest distance of each child from house was measured as CIM range (meter). The red square represents home and the yellow pentagon is a school ([Fig. 1](#)). On this basis, first, each child found the location of home and school on the map of Ilam by the help of a researcher. Second, behavioral and perceptual places for each child were marked on maps. With each behavioral and perceptual places marked on the map, the respondents were asked how they reached the place. Only places that have gone without parent are calculated. The longest distance traveled from home was selected as CIM range ([Fig. 1](#)). A longest path distance was created for each child by converting all behavior places then applying Cost Distance tool within ArcGIS v10.0 to calculate the longest distance traveled from the child's home along school and all behavior or perceptual places. This information was transmitted to the map of detailed plan approved by Ilam city.

2.3.3. CIM time

In the present study, the CIM time as a dependent variable was measured as the average CIM during a week (minute). Despite the fact that the mean CIM time is not objectively measured on a weekly basis, the use of simple reports by children over a short period of

Table 1

Table 1 The three sections of the questionnaire.

section	variables	content	Number of question	Type of answer	responder	Place	Results
1	independent	Closed Questionnaire - Answer	43	Four Likert	Children/parents	Child in school Parents in home school	Children/parents' attitudes toward the relationship of independent variables with CIM range/time
2	Dependent	Cognitive-behavioral map	20	Location on ArcGIS map	Children with the help of researcher		longest distance from home without parents (CIM range)
3		Weekly activity table	1	Record departure/ arrival time at home	Children with the help of parents	home	average weekly child activity outside the home without parents (CIM time)

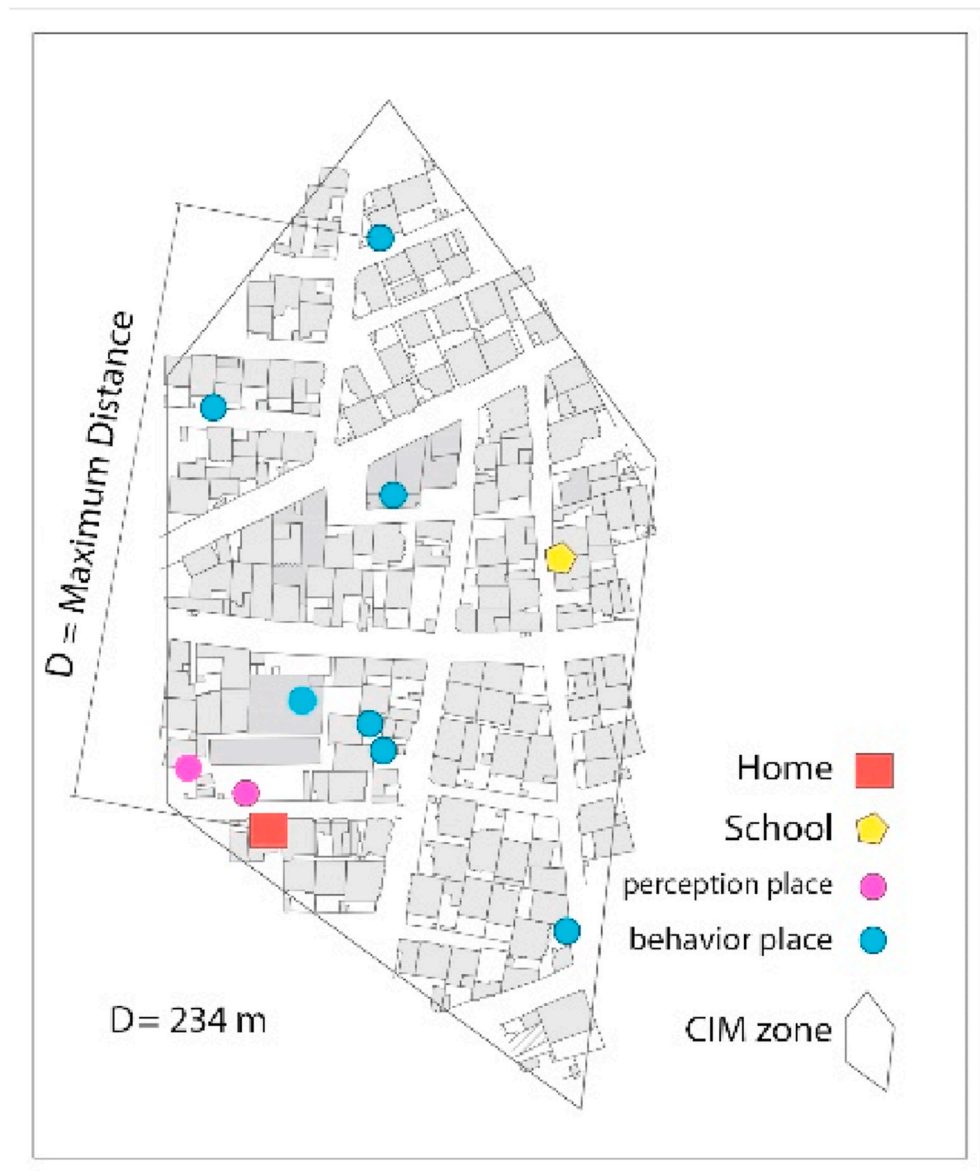


Fig. 1. Fig. 1 An example map of the activity map along with methods for determining the maximum distance from home for each child.

time is reliable (Brodersen et al., 2005). In the present research, a CIM time report was considered for a week. The children were not asked about the CIM time, but the report included a weekly activity table that could record the time of exiting and entering house, as it was easier for children. The CIM time was calculated in minutes for all days of the week except for holidays. The total number of activities was considered for 5 days per week, and it was divided by the number of days of the week, and then the mean daily CIM time was calculated for each child.

2.4. Independent variables

2.4.1. Social-demographic characteristics

The impact of variables such as age, gender, parent education level, family income, school round-trip method, and the children mobility rate on children's activities and games outside the house was also demonstrated (Kerr et al., 2006; Larsen et al., 2009; Villanueva et al., 2012b). The present study examined sex differences between children, roles of children's and parents' age, number of siblings, length of residence in the neighborhood and how round-trips home and school (walking = 1 and by car = 2).

2.4.2. Perceptive characteristics

Perceptive factors in children are related to parent, so that parents' fear of their children's playing outside can be the most important factor in limiting the CIM range in the surroundings. The fear of cars' speed and the children and parents' sense of security are other perceptive factors considered in studies (Foster et al., 2014; Villanueva et al., 2014; Giles-Corti et al., 2011; Zwets et al., 2010). The present research questioned the parent and children's attitudes toward questions such as the safety in the neighborhood and local parks, mobile game duration, play at home, nature, local parks, dead end alleys, game centers, unused land, sandy lands, semi-finished buildings and their children's activities during the night. To answer each of the questions related to perceptual variables, four levels of agreement were defined in terms of the Likert scale (1 = very low, 2 = low, 3 = high and 4 = very high).

2.4.3. Build- environmental characteristics

In the present research, type of housing, house price, net residential density, house area, house with courtyard/no courtyard, yard/terrace area, number of floors, residence floor, and ease of access to local services were investigated as independent build environmental variables. There were three types of housing in Ilam, including one floor with courtyard, apartments, and residential complexes. Housing types were obtained through children questionnaires and confirmation by parent questionnaires. They were then verified by the researcher's field review. In the research, 62.7% of houses were single-floor with courtyard, and 37.3% were apartments without any courtyard. The house price per square meter was determined by asking at least three real estate consultants in that region after house locating by each child and confirming in the parent questionnaire. The net residential density was the result of division of population by residential space with unit of person per hectare. To this end, the factor was calculated in the CIM range by obtaining detailed plans from Ilam municipality, but due to violation of some employers of net residential density according to field surveys, 13 (12%) out of 102 cases were contrary to parent statements and municipality reports. The areas of house and yard or terrace (if they were) were measured in square meters by parents' questionnaires. The number of house floors, the residential floor of each child (Kim, 1997), and the house ease of access to service places of neighborhood (Koohsari et al., 2017; Villanueva et al., 2012a), were also asked in the children and parents' questionnaires.

2.5. Statistical analysis

CIM range and CIM time was considered as the input data of SPSS software in order to measure the relationship between independent variables and CIM range/time. IBM SPSS Statistic version 24 was used to analyze. Multivariate regression models were employed to examine the associations between CIM range/time and housing, perceptive and socio-demographic characteristics. Results were deemed significant at the <0.05 level.

3. Results

The present research provided information on the respondents' social-demographic variables according to the participation of 102 children and their parent (N = 204). Among parent, the participation percentage of mothers was higher than fathers. More than 90% of respondents had at least one brother or sister. Most children often travel to/from school by cars (Table 2).

The present research tries to find perceptive and build-environmental characteristics affecting the CIM range/time. Accordingly, relationships between independent variables and the CIM range/time were separately investigated for boys and girls using the bivariate analysis (Table 3).

Among boys, in addition to a variable related to perceptual variables, there were significant relationships between four build-environment variables and the CIM range. Three build-environment variables, type of housing (apartment) ($P < .001$), number of floors and residential floor have been inverse relation with boys CIM range. Also a perceptual variable, play in home were inversely associated with the boys CIM range. The accessibility to services had a direct relationship with the boys CIM range ($P < .05$). In the case

Table 2

Table 2 Characteristics of participants.

Variable	Description
Dependent variables	Children's independent mobility range (CIM range)
	longest distance from home (meter)
	81% children 250 m longest distance from their home
	Children's independent mobility time (CIM time)
	Average time outdoors on weekdays (minute)
	23.5% children spent 0 min outdoors on weekdays
independent variable	social-demographic characteristics
	Gender child
	55.9 boys and 44.1 girls
	Age child
	21.5%, 12 years' old, 60%, 13 years' old, 18.5%, 14 years' old
	Gender parents
	67.7% male and 32.3% female
	Age parents
	6.9%, 18–30 years' old, 40.2%, 30–40 years' old, 59.2%, 40–55 years' old
	Sibling
	9.8% was alone in home, 49% had a sister/brother, 41.2% more of one
	Residency
	18.6 was 1–2 years, 23.5% 2–5 years, 12.7% 5–8 years and 45.1% out of 8 years
	Travel to school
	75.5% by bus/car, 24.5% walk

Table 3

Table 3 Built environment and perceptual characteristics related to CIM range (meter).

Variable		Boys (216 m)	Girls (159 m)
Build environment characteristics	Housing type; apartment	-.348**	.201
	House price	.138	.012
perceptual characteristics	House area	.194	.172
	Number of floors	-.319*	-.218
	level of residence floor	-.294*	-.345*
	Total building footprint area	.034	.022
	Accessibility to services	.262*	.083
	Children perceptions	Neighborhood safety	.052
		Park safety	-.066
		Play in home	-.266*
		Play in park	.014
		Play in dead-end street	-.079
		Play in nature	-.012
		Play in game net	-.163
		Play in dirty ground	-.069
		Play in semi constructed building	-.162
		Play with mobile	.109
	Parent perceptions	Night activity	-.214
		Neighborhood safety	.014
		Park safety	.174
		Play in home	.041
		Play in park	-.081
		Play in dead-end street	.001
		Play in nature	-.104
		Play in game net	.191
		Play in dirty ground	.122
		Play in semi constructed building	-.183
		Play with mobile	-.032
		Night activity	-.214
			-.084

Note. Pearson correlation was used for continuous variables, and Spearman for categorical variables. Significant correlation values are bolded. **p < .001 and * p < .05.

Table 4

Table 4 Built environment and perceptual factors influencing CIM time (min).

Variable		Boys (32.5 m)	Girls (32.1 m)
Build environment characteristics	Housing type; apartment	-.192	.021
	House price	.138	.083
perceptual characteristics	House area	.328*	.139
	Number of stories	-.146	-.067
	level of residence floor	-.056	-.053
	Total building footprint area	.034	.143
	Accessibility	.217	.207
	Children perceptions	Neighborhood safety	-.203
		Park safety	-.033
		Play in home	-.219
		Play in park	.183
		Play in dead-end street	-.147
		Play in nature	-.022
		Play in game net	-.015
		Play in dirty ground	-.014
		Play in semi constructed building	-.172
		Play with mobile	.213
	Parent perceptions	Night activity	-.211
		Neighborhood safety	.014
		Park safety	.384**
		Play in home	.087
		Play in park	-.093
		Play in dead-end street	.318*
		Play in nature	.344**
		Play in game net	.035
		Play in dirty ground	-.323*
		Play in semi constructed building	-.183
		Play with mobile	-.220
		Night activity	-.046
			.569**

Note. Pearson correlation was used for continuous variables, and Spearman for categorical variables. Significant correlation values are bolded. **p < .001 and * p < .05.

of girls, a build-environment variable and a perceptual variable was significantly related to the CIM range. Like boys, there was a reverse effect of residential floor in apartments on the girls CIM range ($P < .05$). The girls' tendency to play in green and natural spaces was significantly related to the CIM range ($P < .001$).

There were stronger relationships between the research independent variables and boys CIM time (Table 4). Four out of five variables associated with the boys CIM time were perceptual characteristics. There was a significant direct relationship between parents' views on the safety of parks and play in nature with boys CIM time ($P < .001$). Also direct relation of playing in dirty ground and the safety of dead end street have been with boys CIM time ($P < .05$). The house area was directly related to the boys CIM time. Like boys, there were significant relationships between the research independent variables and the girls CIM. Each of five variables were perceptual characteristics and related to parent perception. Respectively playing in game net, nightlife activity, playing in home, play in dead end street and play with mobile had the highest levels of significant relationship to the girls CIM time ($P < .001$).

Bivariate analysis indicates significant relationships between the research variables and CIM range and time. However, the investigation of the research by a multivariate model can indicate the simultaneous effect of variables on 1) CIM range and (2) CIM time. According to the multivariate analysis, among 29 studied variables, 5 variables were significantly related to the CIM range and 5 variables were associated with the CIM time (Table 5).

Results of multivariate model indicated a role of build environment factor in the CIM range, especially boys. Living in apartments has been negative impact on the boys CIM range (-144 m). For each higher floor, CIM range decreased 34 m for boys and 36 m for girls. Meanwhile, the proximity of green and natural spaces up to 48 m affected the increased girls CIM range. The research results indicated that the CIM time was influenced by perceptual factors. Parent perceptions of parks safety and house area affected the boys CIM time until 16 min. Furthermore, the parent's license for children playing in nature had a positive 21 min' effect on the boys CIM time. Parent's license for children's nightly activities increased girls CIM time up to 25 min. In terms of 97.8% of parent and 86.7% of girls, game nets were unsafe places for activity and had a reversed effect on the girls CIM time (98 min).

4. Discussion

4.1. Vertical development of housing and reduction of the CIM range

The results indicated that the CIM range was more dependent build-environment variables, and the CIM time mostly depended on perceptual variables. In the field of CIM range, 5 variables were significant, including four build-environment variables and a perceptual factor. Among build-environment variables affecting the CIM range, level of residence floor has negatively affected both genders. On average, boys and girls CIM range decreased by 35 m for every upper floor. Furthermore, two variables housing type (apartment), and building height inversely affected the boys CIM. Broberg et al. (2013a) found a positive effect of residential density on the CIM range. In another study, the independent mobility of children living in single-household houses was higher than that in apartments and villas (Broberg et al., 2013b). In this research, the independent mobility of children living in apartments was lower than that in single-floor houses. Also, the independent mobility of children living in lower-floor of apartments was higher than that in upper-floor houses. The negative effect of housing vertical development on CIM range was the most important result among build-environment characteristics.

The housing development policy in Iran is through increase height of apartments based on the detailed plan of each city. The housing pattern of Ilam was a single-floor house with the courtyard like most of Iran's cities but owing to implementation of housing development policies, single-floor houses have become apartments. Ilam municipality statistics show that in the past two decades at least $100,000$ single-floor houses became four-floor houses. According to the research results, the CIM range have been reduced 35 m by increase one-floor to houses. Because of increasing the height of buildings and reducing the CIM range that have been proven in this study, is not unexpected reducing the CIM range in Ilam.

4.2. Effects of sex differences on the CIM range and time

Like previous studies, the present research investigated the impact of housing on the definition of the CIM range, but on the

Table 5
Results of Multivariate Model for CIM range and CIM time.

variable		Coefficient (B)	Standardized coefficient (β)	boys	girls
CIM range	Housing type; apartment	-144.280	$-.428$	$.001^{**}$	–
	Number of stories	-52.650	$-.334$	$.011^*$	–
	level of residence floor	-34.715	$-.311$	$.010^*$	–
	Play in nature	48.327	$.332$	–	$.019^*$
	level of residence floor	-36.460	$-.328$	–	$.020^*$
CIM time	Parent perceptions of park safety	16.669	$.325$	$.006^{**}$	–
	House area	16.405	$.392$	$.001^{**}$	–
	parent's fear of play in nature	21.776	$.329$	$.006^{**}$	–
	Parent perceptions of game net safety	-98.750	$.724$	–	$.000^{***}$
	parent's fear of night activity	25.911	$.303$	–	$.000^{***}$

Note. $P < .05$ * $p < .01$ ** $p < .001$ ***, Stepwise selection method was followed.

contrary, it emphasized roles of gender differences in increasing CIM. The CIM range was less than 216 m for boys and less than 159 m for girls. The boys CIM was greater than the girls CIM. This result has been proved in many studies (Carver et al., 2012; Page et al., 2009; Prezza et al., 2010). Some studies have also failed to find any significant gender differences affecting the CIM (Johansson, 2003; Joshi et al., 1999), or found a little impact (Shaw et al., 2013). However, the CIM range was affected by sex differences in the present research, and it was more accurate than CIM. In other words, independent mobility of the present research included the CIM range and time. Therefore, it also studied the roles of gender differences affecting the CIM time. The average CIM time was 32.5 min for boys and 32.1 min for girls, but the difference was not significant. In other words, the CIM time was almost equal in different genders, but the boys CIM was more than the girls. In general, the boys CIM was higher than the girls CIM. Therefore, it should be noted that parents' fear affected the CIM time to be equal for girls and boys.

4.3. Parent fear and reduced CIM time

Four out of five variables affected the CIM time were related to parent perceptions. Children spend most of their time at home as long as they are at home under the influence of parent permission for CIM. The average daily activity time outside the home was 32 min, which was a half of standard daily activity for children aged 5–17 years (WHO, 2010). So like research by Hayley et al. (2015), the parental perception of the environment security affected the CIM. The boys and girls CIM time decreased and were equal under the influence of parent perception. However, the higher range of the boys CIM than the girls CIM was affected by build environment conditions. Two components of parent perceptions, namely game centers conditions and nightlife activities, were the results of fear of insecurity for girls and were significantly proven ($P < .001$). Meanwhile, two variables parent perceptions of park safety and parent's fear of play in nature affected the boys CIM time had lower significant levels ($P < .01$). The result was consistent with some previous studies into parents' major concern about daughters than sons (Foster et al., 2014). Among variables related to the percept in the present research, the parents' fear had the greatest impact on the CIM time. House area, which was associated with build environmental variables, affected the boys' CIM time. It hasn't studied in previous research but experience of living in larger houses made it possible for children to use capabilities of surroundings.

In the field of the CIM range, boys CIM had more than girls. The CIM range was affected by build environmental variables and housing characteristics. It can be argued that the independent mobility range for boys living in single-floor houses with courtyards was significantly higher than that for girls living in residential complexes. Apart from gender inequalities in the present research, the effect of living in upper floors has been proven to reduce the CIM range. There was no gender difference in the field of the CIM time, but parents' fear of having girl's outdoors was higher than their fear of having boys. The CIM time was influenced by parent perceptions of safety conditions. The CIM time decreased regardless of genders, and it was proven by parents' concerns for the presence of their children outside the home. So like a research by Love et al. (2019), among three factors, namely personal, social and environmental factors, social communication played a crucial role in reducing CIM. Also Nansen et al. (2015) considered parent, friends and environment as three factors for the reduction of CIM. In this research proven parents (parents' fear), environment (housing) and gender differences as three factors for the reducing of CIM.

5. Conclusion

The present research evaluated the CIM through two variables CIM range and time. The CIM range was significantly related to build environment variables; and the CIM time significantly depended on perceptual variables. Housing characteristics in the field of build environment variables, and parents' fear in the field of perceptual variables have the greatest relation with CIM. Among the housing characteristics, the most important factor was the negative effect of housing on upper floors of apartments for girls' and boys' CIM. Like previous studies, CIM range and time decreased in the present study. As long as children were at home, the CIM decreased under the influence of parents' fear; and the parents' concerns was higher for girls than boys. As children left the houses, the CIM range was affected by characteristics of residential place; and the boys CIM range was greater than the girls' CIM. Girls compared to boys have undesirable conditions for physical activity and CIM in Ilam. Gender differences have an important impact on CIM.

It is suggested that housing development policies be revised with a focus on reducing the development of high-rise apartments without yards to enhance the CIM range. The roles of sex differences in designing neighborhoods should be considered owing to the girls' lower CIM than boys'. Efforts should be made to promote environmental features of residential neighborhoods to reduce parents' fear of children's presence out of house through various physical, psychological, social, cultural, economic and religious fields.

The present research investigated relationships between CIM and sex differences, housing characteristics, and children/parent perceptions conditions. Although the present research was a progressive study into the conceptualization and measurement of the CIM range and time, and examined roles of housing and parent perceptions of children's activity in local places, the small sample size made it difficult to perform the multivariate analysis and regression, and limited us to discover initial individual differences in the field of local environments. However, the present study investigated the roles of gender differences. This research can be deepened with a larger sample size and attention to diverse cultural, social and build environment backgrounds, such as traditional contexts of urban, suburban and villages. The strengths of the obtained results of the research included the focus on multivariate relationships of housing characteristics and parent perceptions of the CIM range and time for girls and boys. Paying attention to build environment characteristics of CIM in neighborhoods by field studies can deepen and develop statistical studies to understand the relationship between the residential area and children.