Changes in Health-Related Quality of Life After Driving Cessation in Older Adults

Koki Kishimoto¹, Shinichi Noto²

¹ Master’s Program in Rehabilitation Sciences, Graduate School of Niigata University of Health and Welfare, Niigata, Japan
² Major in Rehabilitation Sciences, Graduate School of Niigata University of Health and Welfare, Niigata, Japan

Abstract: Purpose: This study aimed to examine the effects of driving cessation on the health-related quality of life (HRQOL) of older adults who do not have a driver’s license.
Method: A cross-sectional study using a web-based questionnaire was conducted. Participants were 1,200 individuals aged 65 years or older who did not have a driver’s license in Japan. Participants answered questions about their HRQOL (HUI3 and SF-8) and driving cessation using a self-administered questionnaire. Those who had surrendered their driver’s license were also asked about their HRQOL before driving cessation.
Results: The HRQOL scores of the drivers who ceased driving were significantly lower than those of non-drivers. The HRQOL scores of the drivers who ceased driving were also significantly decreased—from -.816 to -.728 (< .001) for the HUI3 and from 51.5 to 49.5 (< .001) for the physical component summary of the SF-8—when comparing scores before and after driving cessation. The results of our multiple regression analysis showed that the number of years since driving cessation and incidence of major illness also affected HRQOL.
Conclusion: There is a clear relationship between driving cessation and a decrease in HRQOL. This confirms the necessity of implementing measures in the future to address this issue, such as securing means of transportation for older people who have ceased driving.
Keywords: driving cessation, health-related quality of life, older adults

Introduction

In recent years, the number of older drivers has been increasing in Japan: the number of driver’s license holders aged 70 years or older has increased to 11.95 million in 2019, accounting for 14.5% of all driver’s license holders. [1]

As a result, accidents caused by older drivers, such as those caused by driving in the wrong direction or mistakenly stepping on the gas pedal and brake, have become a social problem. While the number of fatal accidents per 100,000 licensed population under the age of 75 is 3.1, the number is more than double that—6.9 per 100,000—for those over 75 years old. [2] Furthermore, nearly 50% of those who had undergone cognitive function tests prior to the accident were judged to have “possible dementia” or “possible cognitive decline.” In 2017, the Road Traffic Laws were amended to make it compulsory for drivers aged 75 and above to take an older adult’s driving course and cognitive function test when renewing their license every three years. [3]

The number of people who voluntarily surrender their driver’s license is increasing, as the trend of encouraging older adults, as well as their families, to do so spreads. In 2012, 81,711 people surrendered their licenses; this number increased to 200,000 in 2015, 358,740 in 2019, and 510,918 in 2020. [1].

Recent studies on driving cessation among older adults find that driving cessation is accompanied by substantial declines in physical and social function, physical performance, and physical role. Edwards et al. followed the lives of community-dwelling older adults for five years and report a rapid decline in health-related quality of life (HRQOL) with driving cessation. [4] Edwards et al. also report that driving cessation increased mortality.
by up to four to six times after three years. [5] There are also existing reports of a significant increase in depressive symptoms after driving cessation and results showing that not driving increases the risk of future nursing home placement. [6, 7] Furthermore, a study in Japan reports that driving cessation is associated with an increased risk of functional limitations in older adults; however, the study states that this risk of functional limitations may be reduced if independent mobility can be maintained using public transportation or bicycles after driving cessation. [8]

To date, no study has examined the impact of driving cessation on the HRQOL of older adults in Japan. In addition, if HRQOL is decreased by the surrendering of a driver’s license, it is necessary to clarify the factors that contribute to this decrease. Therefore, this study examines the changes in HRQOL related to the surrender of a driver’s license and examine how much the driving cessation affects the body and mind.

Methods

Study Design and Participants

We conducted a cross-sectional study using a web-based questionnaire. The survey was conducted by Rakuten Insight, Inc. in December 2020. The number of participants was set at 1,200 and the ratio of male to female participants was set at 1:1. Participants who did not have a driver's license were recruited from a panel of one account per person pre-registered on Rakuten Insight, Inc. For each question, the respondents were asked to answer in a selective manner, except for some free descriptions. To eliminate differences between the metropolitan and rural areas, the number of questionnaires collected in Tokyo and Osaka was limited to 200 per city, and the same upper limit was set for each prefecture.

Questionnaires

Participants answered questions related to their HRQOL and driving status in a self-administered questionnaire. Those who had ceased driving were retrospectively asked about their HRQOL before they surrendered their driver’s license. Respondents’ HRQOL was measured using the Short Form-8 survey (SF-8) and the Health Utilities Index – Mark 3 (HUI3). The SF-8 is an abridged version of the Short Form-36 survey that measures HRQOL. [9] The SF-8 contains eight items that are separated into two components; physical health (domains: physical functioning, role physical, bodily pain, and general health) and mental health (domains: vitality, social functioning, role emotional, and mental health). Each subscale used norm-based scoring, with a higher value indicating a higher HRQOL. [10] The HUI3 is a generic, multi-attribute, preference-based system for assessing HRQOL. [11] The system defines 972,000 unique health statuses, as it focuses on eight attributes (vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain or discomfort), with each stratified into five to six functional levels. The global score shows health utility, with 0 indicating death and 1 indicating perfect health. The scoring function developed by Noto et al. was used to calculate the global HUI3 score. [12]

Those who had ceased to drive were asked the following questions: 1) How long ago they surrendered their driver’s license, 2) Who made the decision to surrender their driver’s license, 3) Whether they had any illness or injury that interfered with their life after surrendering their driver’s license, 4) The purpose of their car, 5) The problems they faced when they surrendered their driver’s license, and 6) What services they received after surrendering their driver’s license.

Statistical Analysis and Ethical Procedures

The HRQOL of those who surrendered their driver’s license and those who did not drive were compared; further, for those who surrendered their license, their HRQOL scores before and after surrender were compared using a paired t-test. A multiple regression analysis was conducted using the HRQOL scores after driver’s license surrender as the objective variable. The explanatory variables used were age, gender, economic status, distance from home to the transportation facility normally used, and whether or not the license was surrendered. In addition, the difference in HRQOL before and after the surrender of the driver’s license was determined, and with that as the objective variable, related factors were examined by multiple regression analysis. The significance level was set at 0.05. Statistical analyses were performed using STATA 16.0 software. This study was approved by the Ethics Committee of the Niigata University of Health and Welfare (No. 18549–201221). Written informed consent was obtained from all participants who took part in the study.

Results

Participant Characteristics

Table 1 shows the results in terms of the entire sample, those who did not drive, and those who had ceased driving. The mean age of the total sample was 72.3 (±5.3) years, 71.2 (±5.1) years for those who never had a driver’s license, and 73.9 (±5.3) years for those who had ceased driving. Our comparison of the two groups showed differences in education, income per month, and family structure. There was no difference in
Table 1. Socio-demographic characteristics of respondents

| Variable                        | Total sample (n=1200) | Non-drivers (n=733) | Ceased drivers (n=467) | p value |
|---------------------------------|-----------------------|---------------------|------------------------|---------|
| Age                             | 72.3 ± 5.3            | 71.2 ± 5.1          | 73.9 ± 5.3             | <0.001  |
| Sex                             |                       |                     |                        |         |
| Male                            | 600                   | 287                 | 313                    | <0.001  |
| Female                          | 600                   | 446                 | 154                    |         |
| Education                       |                       |                     |                        | 0.002   |
| Junior High                     | 45                    | 27                  | 18                     |         |
| High                            | 484                   | 320                 | 164                    |         |
| Junior College                  | 197                   | 130                 | 67                     |         |
| University                      | 421                   | 230                 | 191                    |         |
| Graduate                        | 53                    | 26                  | 27                     |         |
| Monthly income (JPY)            |                       |                     |                        | <0.001  |
| <100,000                        | 363                   | 255                 | 108                    |         |
| 100,000-200,000                 | 444                   | 268                 | 176                    |         |
| 200,000-300,000                 | 248                   | 138                 | 110                    |         |
| >300,000                        | 145                   | 72                  | 73                     |         |
| Household status                |                       |                     |                        | 0.001   |
| Single household                | 289                   | 170                 | 119                    |         |
| Couple only                     | 600                   | 343                 | 257                    |         |
| Two households                  | 267                   | 191                 | 76                     |         |
| Three households                | 44                    | 29                  | 15                     |         |
| Distance from public transportation |                     |                     |                        | 0.564   |
| < 5 minutes                     |                       |                     |                        |         |
| 5-10 minutes                    | 420                   | 255                 | 165                    |         |
| 10-15 minutes                   | 424                   | 265                 | 159                    |         |
| 15-20 minutes                   | 214                   | 121                 | 93                     |         |
| >20 minutes                     | 70                    | 45                  | 25                     |         |
|                                | 72                    | 47                  | 25                     |         |

SD: Standard Deviation

terms of distance from public transportation.

**HRQOL Scores**

Table 2 shows the global HUI3 and SF-8 scores. The overall HUI3 score was .777 (±.205) for non-drivers and .728 (±.235) for those who ceased driving, showing a significant difference (p < .001). In terms of the SF-8, there was a difference in physical functioning, role physical, and physical component summary (PCS) between the two groups. Table 3 shows a comparison of the results of those who ceased driving before and after surrendering their licenses; there was a significant decrease in the global HUI3 score and in all SF-8 subscores.

**Responses regarding driving cessation**

A variety of responses were obtained to the questions posed to those who ceased driving. The most common illnesses and injuries that occurred after driving cessation were cancer, fracture, heart failure, and stroke. The most common uses of the car were commuting and daily life. The most common problems after surrendering the license were work, distance to the station, and identification. As for the services they received, they answered that they received discounts for transportation and shopping.

**Regression Analysis**

Table 4 shows the results of the multiple regression analysis with the global HUI3 score and the SF-8 score as the objective variables. Considering the global HUI3 score and the PCS component of the SF-8, in addition to driving cessation, low income per month and distance from public transportation had a negative impact on
HRQOL. Moreover, in terms of the mental component summary (MCS) of the SF-8, driving cessation had no significant effect. Table 5 shows the results of our multiple regression analysis, with the difference between the global HUI3 score and the PCS and MCS scores of SF-8 before and after driving cessation as the objective variables. The global HUI3 score and the PCS component of the SF-8 were affected by driving cessation and incidence of illness, while the MCS component of the SF-8 was affected only by incidence of illness.

Discussion

This study used an online questionnaire survey to determine whether driving cessation is a factor in the decline of HRQOL among older adults. Of the 1,200 respondents, 467 ceased driving; we believe that we were able to collect a large enough sample to withstand statistical processing.

**HRQOL Scores**

First, we compared the HRQOL results —according to the HUI3 and SF-8 measures—of all respondents with the national norm. According to Shiroiwa et al., the average HRQOL scores for males and females in their 70s was .807 and .818, respectively; our results were lower than these values. [13] A possible reason for this difference is that Shiroiwa et al. used a face-to-face survey, while our study used a web-based survey. They also reported that the ePRO survey showed lower scores than the paper-based survey, which may be related to same factors. [14] However, it has been reported that...
there was no significant difference between the ePRO and paper-based surveys in other countries [15, 16]; therefore, the influence of Japanese characteristics needs to be further examined. As for the SF-8 scores, the results were higher than the adjusted threshold of 50 for general health, and the difference in HRQOL indicated by the HUI3 became apparent. This may be because HRQOL is calculated by HUI3, a preference-based in-

| Table 4 | Relation between HRQOL scores, characteristics and driving cessation |
|---------|---------------------------------------------------------------|
| Variable | Coefficient | p value | 95%CI |
| HUI3    |             |         |      |
| Sex     | 0.063       | <0.001  | 0.036 to 0.090 |
| Age     | –0.004      | 0.001   | –0.006 to –0.002 |
| Driving Cessation | –0.034 | 0.011 | –0.060 to –0.008 |
| 1 month income |         |         |      |
| <100,000 | –0.120      | <0.001  | –0.163 to –0.076 |
| 100,000-200,000 | –0.093   | <0.001  | –0.133 to –0.053 |
| 200,000-300,000 | –0.043   | 0.052   | –0.087 to 0.000 |
| > 300,000 | reference   |         |      |
| Distance |             |         |      |
| < 5 minutes | 0.095     | <0.001  | 0.042 to 0.148 |
| 5-10 minutes | 0.061     | 0.025   | 0.008 to 0.114 |
| 10-15 minutes | 0.070     | 0.016   | 0.013 to 0.126 |
| 15-20 minutes | 0.031     | 0.384   | –0.039 to 0.101 |
| >20 minutes | reference   |         |      |
| PCS     |             |         |      |
| Sex     | 1.125       | 0.003   | 0.382 to 1.868 |
| Age     | –0.111      | 0.001   | –0.176 to –0.047 |
| Driving Cessation | –0.832   | 0.024   | –1.553 to –0.110 |
| 1 month income |         |         |      |
| <100,000 | –1.598      | 0.009   | –2.793 to –0.404 |
| 100,000-200,000 | –1.303    | 0.021   | –2.407 to –0.199 |
| 200,000-300,000 | –0.689   | 0.261   | –1.891 to 0.513 |
| > 300,000 | reference   |         |      |
| Distance |             |         |      |
| < 5 minutes | 2.433    | 0.001   | 0.972 to 3.893 |
| 5-10 minutes | 1.992    | 0.007   | 0.534 to 3.451 |
| 10-15 minutes | 1.934   | 0.015   | 0.373 to 3.494 |
| 15-20 minutes | 1.800   | 0.066   | –0.121 to 3.720 |
| >20 minutes | reference   |         |      |
| MCS     |             |         |      |
| Sex     | –0.135      | 0.702   | –0.829 to 0.558 |
| Age     | 0.032       | 0.298   | –0.028 to 0.092 |
| Driving Cessation | 0.093    | 0.787   | –0.581 to 0.766 |
| 1 month income |         |         |      |
| <100,000 | –2.137      | <0.001  | –3.252 to –1.022 |
| 100,000-200,000 | –1.057   | 0.044   | –2.087 to –0.027 |
| 200,000-300,000 | –0.222   | 0.698   | –1.344 to 0.900 |
| > 300,000 | reference   |         |      |
| Distance |             |         |      |
| < 5 minutes | 0.801     | 0.249   | –0.562 to 2.165 |
| 5-10 minutes | 0.704     | 0.311   | –0.657 to 2.065 |
| 10-15 minutes | 0.234    | 0.753   | –1.223 to 1.690 |
| 15-20 minutes | 0.393    | 0.667   | –1.399 to 2.186 |
| >20 minutes | reference   |         |      |

Adjusted R2: 0.071 for HUI3, 0.039 for PCS, 0.028 for MCS. CI: confidence interval.
Comparison of HRQOL between Non-drivers and Ceased Drivers
In the comparison of HRQOL between non-drivers and those who ceased driving, the physical functioning, role physical, and PCS of the HUI-global score and SF-8 were lower for those who ceased driving.

Furthermore, our multiple regression analysis showed that the factor of never driving or ceasing to drive was significantly associated with a decrease in HRQOL, confirming the results of Edwards et al., who reported that health deteriorated after driving cessation. [4] The results of our multiple regression analysis showed that the distance from the nearest public transportation was significantly related to a decrease in HRQOL, which we found meaningful. It is known that driving cessation decreases the level of activity outside the home. [17,18] A study by Hirai et al. suggests that older adults may be at increased risk of functional limitations if they cease driving, but that this risk may be reduced to some extent if they are able to maintain independent mobility by using public transportation or by bicycling. [8] Furthermore, it has been reported that people are more likely to be homebound if the distance to the closest retail store is farther. [19] We believe that the distance of public transportation from home is an important factor of reduced HRQOL, for both non-drivers and for those who have ceased driving.

Comparison of HRQOL Before and After Driving Cessation
Significant differences in HRQOL before and after the driving cessation were found for two items: time passed since driving cessation and whether the person experienced any major illness or injury after cessation. Although it is not clear whether the factors affecting these items were due to driving cessation or to illness after the cessation, it is worth noting that these results are similar to those of Edwards et al. [4]

In present study, people who stopped driving were

dex-type measure, which is more likely to show changes than SF-8, which is a profile-type measure.

| Variable                  | Coefficient | p value | 95% CI      |
|---------------------------|-------------|---------|-------------|
| **HUI3**                  |             |         |             |
| Sex                       | –0.034      | 0.049   | –0.067 to 0.000 |
| Age                       | –0.003      | 0.075   | –0.006 to 0.000 |
| Years of Driving Cessation| –0.005      | <0.001  | –0.007 to 0.003 |
| Decided by myself          | 0.007       | 0.860   | –0.073 to 0.087 |
| Major illness              | –0.056      | 0.007   | –0.096 to –0.015 |
| Trouble                    | –0.017      | 0.347   | –0.019 to 0.053 |
| Receive service            | –0.005      | 0.771   | –0.030 to 0.041 |
| **PCS**                   |             |         |             |
| Sex                       | 0.372       | 0.478   | –0.659 to 1.403 |
| Age                       | –0.045      | 0.336   | –0.138 to 0.047 |
| Years of Driving Cessation| –0.177      | <0.001  | –0.242 to 0.112 |
| Decided by myself          | –0.355      | 0.777   | –2.818 to 2.108 |
| Major illness              | –1.756      | 0.006   | –3.004 to –0.507 |
| Trouble                    | –0.909      | 0.108   | –2.019 to 0.201 |
| Receive service            | –0.187      | 0.739   | –0.912 to 1.286 |
| **MCS**                   |             |         |             |
| Sex                       | –1.079      | 0.014   | –1.943 to 0.215 |
| Age                       | –0.065      | 0.100   | –0.143 to 0.013 |
| Years of Driving Cessation| –0.005      | 0.847   | –0.049 to 0.060 |
| Decided by myself          | –0.332      | 0.752   | –2.396 to 1.733 |
| Major illness              | –1.676      | 0.002   | –2.723 to –0.630 |
| Trouble                    | –0.196      | 0.678   | –1.127 to 0.734 |
| Receive service            | 0.615       | 0.190   | –0.306 to 1.536 |

Adjusted R²: 0.090 for HUI3, 0.103 for PCS, 0.042 for MCS. CI: confidence interval.
asked to recall the time before they stopped driving and to fill in their HRQOL at that time. It is known, however, that a response shift often occurs in an HRQOL survey over time [20,21]; therefore, we cannot deny that there was an effect of this factor. Thus, it should be noted that a cross-sectional study such as ours cannot clarify this causal relationship, and we believe that future prospective studies are needed.

Currently, older people in Japan are more positive about the cessation of driving than ever before. However, older adults are able to maintain independent mobility and meet their daily needs by driving, using public transportation, and bicycles. Therefore, we posit that older adults who have ceased driving should be supported by introducing alternative transportation that is convenient and safe to use. For the questionnaire item asking whether they received any service after surrendering their license, 349 out of 467 respondents answered that they did not receive any alternative transport services. We were unable to determine whether the services are not available, or whether they know about the services but do not make use of them; regardless, we believe that ensuring a full range of transportation for older adults who have ceased driving is important for reducing the subsequent decline in their HRQOL.

Relationship between occupational therapy and driving cessation

Driving is not only a means of transportation, but also a way to enjoy driving itself and to directly connect driving with leisure and other activities that are meaningful to the person. Therefore, the loss of driving has the potential to lead to the loss of meaningful occupation itself. Occupational therapy should be actively involved in the development of safe driving techniques and the provision of alternative transportation in the community.

Limitations

Despite its clear contributions, there are certain limitations to this study. We used an online survey platform and asked people aged 65 and above to complete the web-based questionnaire; therefore, we cannot discount the possibility that there was a selection bias of older adults who are accustomed to using the Internet. In addition, we set a maximum value for the number of respondents recruited who are living in urban areas, to thereby reduce bias by region; however, as it was only set for each prefecture, we could not strictly distinguish between urban and rural areas. As the effects of driving cessation in urban and rural areas are expected to be decisively different, it was thought important to set the sample with this point in mind in the future. Furthermore, when asked if they had any problems after returning their driver’s license, 334 out of 467 respondents answered that they did not have any problems, suggesting that the reason for returning their driver’s license may have been that some may no longer have needed a car. A follow-up study is necessary to examine the details of the reasons for driving cessation and to clarify the relationship with HRQOL.

Conclusion

This cross-sectional study using a web-based questionnaire among older adults aged 65 years or older who did not hold a driver’s license showed that those who ceased driving had lower HRQOL than those who did not drive. In addition, among older adults who surrendered their driver’s licenses, HRQOL was significantly lower after driving cessation than before; moreover, this factor was affected by the number of years since driving cessation and incidence of major illness. Although the causal relationship between driving cessation and illness could not be clarified, the results suggest that measures such as securing transportation for older adults who have ceased driving are necessary.

Conflicts of Interest Statement

The authors have no conflicts of interest relevant to this article.

Acknowledgements

We would like to thank Honyaku Center Inc. for English language editing.

References

[1] National Police Agency [online]. Driver’s License Statistics 2020 [accessed on 4 September 2021]. Available from: https: //www.npa.go.jp/publications/statistics/koutsuu/menkyo/r02/r02_main.pdf
[2] Cabinet Office [online]. Current Status of Traffic Accidents involving Elderly Drivers. White Paper on Traffic Safety, 2020 [accessed on 4 September 2021]. Available from: https://www8.cao.go.jp/koutu/taisaku/r02kou_haku/pdf/gaiyo.pdf
[3] National Police Agency [online]. Cabinet Office Ordinance on the Partial Revision of the Ordinance for Enforcement of the Road Traffic Act 2017 [accessed on 4 September 2021]. Available from: https://www.npa.go.jp/bureau/traffic/law/291030/3.pdf
[4] Edwards JD, Lunsman M, Perkins M, Rebok GW, Roth DL. Driving cessation and health trajectories in older adults. J Gerontol A Biol Sci Med Sci. 2009; 64(12): 1290–5.
[5] Edwards JD, Perkins M, Ross LA, Reynolds SL. Driving status and three-year mortality among community-dwelling older adults. J Gerontol A Biol Sci Med Sci. 2009; 64(2): 300–5.

[6] Marottoli RA, Mendes de Leon CF, Glass TA, et al. Driving cessation and increased depressive symptoms: prospective evidence from the New Haven EPESE. Established Populations for Epidemiologic Studies of the Elderly. J Am Geriatr Soc. 1997; 45(2): 202–206.

[7] Freeman EE, Gange SJ, Muñoz B, West SK. Driving status and risk of entry into long-term care in older adults. Am J Public Health. 2006; 96(7): 1254–9.

[8] Hirai H, Ichikawa M, Kondo N, Kondo K. The Risk of Functional Limitations After Driving Cessation Among Older Japanese Adults: The JAGES Cohort Study. J Epidemiol. 2020; 30(8): 332–337.

[9] Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992; 30(6): 473–83.

[10] Fukuhara S, Suzukamo Y. Health-related quality of life scale (in Japanese). Igaku no Ayumi. 2005; 213: 133–6.

[11] Feeny, D., Furlong, W., Torrance, G. W., Goldsmith, C. H., Zhu, Z., DePauw, S., et al. Multiattribute and single-attribute utility functions for the health utilities index mark 3 system. Med Care. 2002; 40(2): 113–128. doi: 10.1097/00005650-200202000-00006.

[12] Noto, S., Shiroiwa, T., Kobayashi, M., Murata, T., Ikeda, S., & Fukuda, T. Development of a multiplicative, multi-attribute utility function and eight single-attribute utility functions for the Health Utilities Index Mark 3 in Japan. J Patient Rep Outcomes. 2020; 4(1): 23.

[13] Shiroiwa T, Noto S, Fukuda T. Japanese Population Norms of EQ-5D-5L and Health Utilities Index Mark 3: Disutility Catalog by Disease and Symptom in Community Settings. Value Health. 2021; 24(8): 1193–1202.

[14] Shiroiwa T, Hagiwara Y, Taira N, Kawahara T, Konomura K, Iwamoto T, Noto S, Fukuda T, Shimozuma K. Randomized Controlled Trial of Paper-Based at a Hospital versus Continual Electronic Patient-Reported Outcomes at Home for Metastatic Cancer Patients: Does Electronic Measurement at Home Detect Patients' Health Status in Greater Detail? Med Decis Making. 2021: 272989X211010171.

[15] Norquist J, Chirovsky D, Munshi T, Tolley C, Panter C, Gater A. Assessing the Comparability of Paper and Electronic Versions of the EORTC QOL Module for Head and Neck Cancer: A Qualitative Study. JMI Cancer. 2017; 3(1): e7.

[16] Ring AE, Cheong KA, Watkins CL, Meddis D, Cella D, Harper PG. A Randomized Study of Electronic Diary versus Paper and Pencil Collection of Patient-Reported Outcomes in Patients with Non-Small Cell Lung Cancer. Patient. 2008; 1(2): 105–13.

[17] Marottoli RA, Mendes de Leon CF, Glass TA, et al. Consequences of driving cessation: decreased out-of-home activity levels. J Gerontol B Psychol Sci Soc Sci. 2000; 55(6): S334–S340.

[18] Shimada H, Makizako H, Tsutsumimoto K, Hotta R, Nakakubo S, Doi T. Driving and Incidence of Functional Limitation in Older People: A Prospective Population-Based Study. Gerontology. 2016; 62(6): 636–643.

[19] Hirai H, Kondo N, Sasaki R, Iwamuro S, Masuno K, Ohtsuka R, Miura H, Sakata K. Distance to retail stores and risk of being homebound among older adults in a city severely affected by the 2011 Great East Japan Earthquake. Age Ageing. 2015; 44(3): 478–484.

[20] Schmalz G, Garbade J, Kollmar O, Zielbolz D. Does oral health-related quality of life of patients after solid organ transplantation indicate a response shift? Results of a systematic review. BMC Oral Health. 2020; 20(1): 356.

[21] Ilie G, Bradfield J, Moodie L, Lawen T, Ilie A, Lawen Z, Blackman C, Gainer R, Rutledge RDH. The Role of Response-Shift in Studies Assessing Quality of Life Outcomes Among Cancer Patients: A Systematic Review. Front Oncol. 2019; 9: 783.