

Research Article

Good vision – good driver

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Summary

Vision is a complex act that allows the visual analyzer to perceive and analyse objects in the environment. The teams of two eye clinics conducted a “good vision-good driver” awareness campaign in combination with a survey. In most countries in the world, drivers over the age of 65 are required to renew their licences every 2 or 3 years. The European Commission wants car drivers over 70 to prove their ability every 5 years. The aim was to analyze the relationship between patients’ visual performance concerning their self-reported driving and their subjective general health. The survey was conducted through a direct survey at St. Nikolay Chudotvorets Eye Clinic Eye Clinics from 1.06.2021 to 31.06.2022. For the period, 103 patients were surveyed, 84 male and 19 – female. The group of 50–70-year-olds was the most numerous. Uncorrected vision equal to or less than 0.3 was present in 45.6% of all 206 eyes. Almost all respondents drove a car, only 3 were not drivers, and most (50.9%) had no difficulty driving. More than 42% of the respondents found driving difficult only at night, and 6.8% had difficulty always. There is an overlap in the results of the questions of whether the patient had had a traffic accident – positive in 13.7% and whether they had ever had a stroke. The ability to drive is a multifactorial process in which vision plays an undeniable role. Visual acuity reflects the need for correction in the driving licence. The present research proves the need because it shows patients with poor vision driving and not at a young age who overestimate their general and visual objective condition.

Key words: Driver, impaired vision, traffic accident

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Eyes that look are something ordinary. Eyes that see are rare.

Oswald Sanders

Introduction

Vision is a complex act that allows the visual analyzer to perceive and analyze objects in the environment. A visual impairment occurs when an eye disease affects the visual system and impairs one or more functions. Many eye diseases, especially those of social importance in Bulgaria, are the subject of numerous prevention, screening, or follow-up campaigns. The most significant of them are: “Right to Sight 20/20”, Kwiat’s campaign for the prevention of children’s vision, the National Screening Campaign “Sight is Everything! Check Yourself!”, Eye Hospital Varna- “Your vision is important to us,” Varna Municipal Program for Children’s

Vision Protection, “LIONS CLUB – We Serve” – Children’s Vision Screening, etc. In this aspect, the team of St. Nikolay Chudotvoretz Eye Clinic - Varna conducted an awareness campaign, “**good vision, good driver,**” combined with a survey of its patients. Vision problems can seriously impact a person’s ability to drive. Visual impairment is of huge importance to the quality of life, which in the modern world is invariably linked to driving increasingly powerful and modern cars. This is a very serious issue and needs public and legislative attention.

A medical certificate of physical fitness of a driver in Bulgaria is required for the initial acquisition of a driving license and any subsequent replacement due to expiry or obtaining a new category. Regulation № 3 published in the State Gazette from 2011 on physical fitness requirements for drivers divides them into two groups (State Gazette 2011) (Table 1). Group 1 includes drivers of all categories of vehicles. For them, the medical certificate is certified by the GP after an examination, and examinations by specialists are only carried out if the GP decides. Group 2 includes drivers of all categories: C, D, Ttm, and Ttb. For them, the medical certificate shall be certified by a general practitioner after examination by all the specialists defined in Regulation № 3.

Table 1. Diseases and conditions that impose restrictions on obtaining a driving licence depending on the category of the vehicle, REGULATION No.3 of 11 May 2011.

Name of diseases and conditions		Group 1	Group 2
		categories “AM”, “A”, “A1”, “A2”, “AM”, “B”, “B1”, “VE”, “Tkt”	categories “C”, “CE”, “C1”, “C1E”, “D”, “DE”, “D1”, “D1E”, “Ttm”, “Ttb”
Eye diseases:			
1	Severe congenital, inflammatory and degenerative diseases of the eyeball and its appendages leading to permanent and irreversible disorders of the ocular functions - subject to the requirements of item 6	Allowed	Forbidden
2	One-eyedness:		
	(a) free from refractive error, functionally or anatomically, with normal functions of the eye used; and under the condition of at least 3 years after receiving the monocularly established by an appropriate medical document;	Allowed only for cat. “B1”, “B” and “B+E”	Forbidden
	b) with a refractive error of +/- 2 diopters of the eye used, the patient must be sent to transport regional medical expert committee (TRMEC)	Individual	Forbidden
3	Glaucoma - compensated - normal visual field and under the conditions of item 6	Allowed	Forbidden
4	Congenital color perception disorders:		
	a) anomalous trichromasia (color anomaly);	Allowed	Allowed only for cat. “C1”, “C”
	b) anomalous trichromasia and visual acuity of at least 0.8 in the stronger eye and at least 0.5 in the weaker eye with an appropriate correction by corrective spectacles or contact lenses;	Allowed	Forbidden
	(c) dichromasia and monochromasia	Forbidden	Forbidden
5	Acquired color perception disorders depending on the degree:		
	(a) visual acuity of at least 0.8 in the stronger eye and at least 0.5 in the weaker eye with appropriate correction by corrective spectacles or contact lenses	Allowed	Forbidden
	b) peripheral vision testing of both eyes (normal visual field)	Allowed	Individually
	(c) in other cases	Forbidden	Forbidden
6	Visual acuity 1 with normal other ocular functions 2:		
	(a) the sum of the visual acuities of the two eyes shall be equal to 2,0, the weaker eye being not less than 1,0 with correction up to ± 2 diopters inclusive, with each eye without correction $\geq 0,05$;	Allowed	Allowed
	(b) the sum of the visual acuities of the two eyes shall be equal to 1,8, the weaker eye being not less than 0,8 with correction up to ± 3 diopters inclusive and each eye without correction $\geq 0,05$;	Allowed	Individually
	(c) the sum of the visual acuities of the two eyes shall be equal to 1,6, the weaker eye being equal to 0,6 using a correction of ± 8 diopters inclusive	Allowed	Forbidden
7	Diplopia	Forbidden	Forbidden

A general practitioner shall not certify a driver’s physical fitness certificate in the presence of more than one disease within the scope of Regulation No.3, physical disability and the need for a TRMEC certificate, or if a previous one is available. TRMEC carries out expert certification of drivers with disabilities sent by the Police Department and the Medical Labour Expert Commission (MLEC) and resolves disputed cases of occupational and physical fitness of railway employees and those in maritime and road transport.

The law clearly mentions the following remarks in our country: 1. Visual acuity is corrected with glasses or contact lenses. 2. Normal ocular functions are to be understood as visual acuity of at least 1.0 in each eye; visual field in degrees: nasal – 55; temporal – 90; superior – 45; inferior – 60; visual adaptation established by an adaptometer; colour perception tested with the colour charts in our country and controlled with an anomaloscope; stereoscopic vision; normal ocular mobility in all principal directions 45 degrees. The regulation itself sets clear medical limits, but it is quite another question whether and how they are respected.

Art. (1) of Suppl. H “ORDINANCE amending and supplementing Ordinance No. I-157 of 2002 on the conditions and procedure for issuing licenses for driving motor vehicles, driver reports and their discipline” (SG No. 18 of 2013, in force from 22.02.2013), regulates the form of the Bulgarian national driving license. It must be prepared in ID-1 format in accordance with Annex I of Directive 2006/126/EC of the European Parliament and of the Council (Table 2).

There is some variation from country to country, but most require Group 1 drivers to meet the standard limit of 6/12 in the better eye or both eyes tested together. It is stricter for Group 2 drivers - a minimum visual acuity of 6/9 in the better eye. For example, the General Traffic Directorate of the Royal Oman Police requires a best-corrected visual acuity of 6/6 in at least one eye for an amateur license and at least 6/12 in each eye for a professional driver’s license. The

Table 2. Bulgarian national driving licence shall be produced in ID-1 format.

(2) The driving licence shall contain the following data:

1. names;
 2. date and place of birth;
 3. personal identification number;
 4. gender;
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 17. special remarks (restrictive conditions for the use of the certificate);

18. The restrictive conditions for the use of the certificate referred to in Art. 53, paragraph 1 shall be written in codes and shall have the following meanings:

- DRIVER (Medical reasons)
01. Vision correction and/or protection
 - 01.01. Glasses
 - 01.02. Contact lens(es)
 - 01.05. Eye bandage
 - 01.06. Glasses or contact lenses
 - 01.07. Specific optical aid
 02. Hearing aid/speaking aid
-

legal framework in Russia is similar – Order No. 344 of 03.2020–2021 states that in order to obtain an amateur driving license, examinations must be carried out by a therapist, an ophthalmologist, a psychiatrist, and a neurologist for all categories C, D, and Tm, Tb, otolaryngologist, and electroencephalography and determination of the presence of psychoactive substances are required for the latter categories. In Switzerland, a medical examination is compulsory every two years for all drivers above 70 (Sebo 2020). A revision of the Road Traffic Law in January 2019 raised the minimum age for this examination to 75 years. It is carried out by general practitioners, except in Geneva, where Road Service medical examiners carry it out. The findings: around 2% of older drivers were considered unsuitable for driving in Switzerland, mainly due to cognitive (64%) and visual (18%) impairments.

Some countries have tightened license renewal requirements for older drivers. In our country, according to Ordinance I-157/01.10.2002 on the conditions and procedure for issuing a driving license - the validity period of the document is ten years, five years for categories C, D, E, T, and up to 5 years for categories B, C, D, E, T. However, the document is given for 15 years in Germany, while in Belgium and France, the license is unlimited. In most countries, drivers over 65 must renew their licences every two or three years and prove their skills with a driving test. The European Commission also wants car drivers in Europe over 70 to prove their driving ability every 5 years. It also defines specific medical criteria for adult drivers over 70 to wear glasses or contact lenses with a diopter. In the case of eye disease, the driver must present a medical certificate - just as for diseases of the cardiovascular and nervous systems. It is not recommended to extend the validity of the driving license in case of motor system diseases. This recommendation also applies to people with severe diabetes and cognitive and intellectual disabilities, as well as those with dementia and alcoholism.

The present study aimed to analyze the relationship between patients' visual performance concerning their self-assessment of driving and their subjective general health.

Material and methods

The study was conducted in the St. Nikolay Chudotvoretz Eye Clinics in Varna and Burgas from 1.01.2021 to 30.06.2022, with a direct survey with specially selected questions (annex 1). A specially developed survey card using the direct survey method was used. It was conducted under standard conditions and included 14 questions of the closed type - with yes or no answers. The eye examination includes examination of near and far vision with and without correction and visual field, if necessary. The obtained results were processed with Microsoft Excel 2013 software products.

Results

From 1.01.2021 to 30.06.2022, 103 patients were surveyed at the Medical Centers. Of them, 84 were male and 19 were female. The largest group of respondents was 50–70 years old. The data from the general introductory questions are given in Fig. 1.

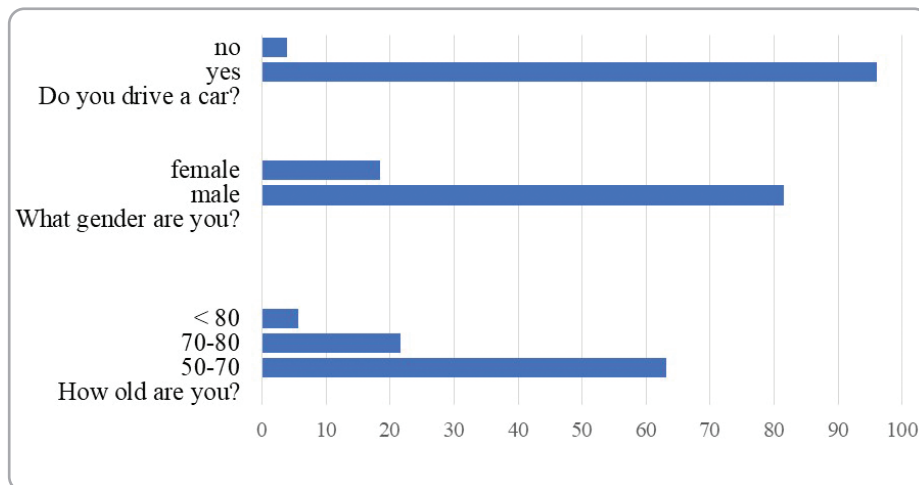


Figure 1. Results of general data.

Visual acuity testing was performed by ophthalmologists and was checked on each eye individually, both uncorrected and best corrected. The results are given in Table 3.

Table 3. Ratio by visual acuity.

	Vision without correction	N eyes- 206 in total	%	Vision with correction	N eyes- 206 in total	%
1.	0–0.05	22	10.6%	0–0.05	9	4.3%
2.	0.1–0.3	72	34.9%	0.1–0.3	21	10.1%
3.	0.4–0.8	98	47.5%	0.4–0.8	81	39.3%
4.	0.8–1.0	14	6.7%	0.8–1.0	95	46.1%

Uncorrected vision equal to or less than 0.3 was found in 45.6% of all 206 eyes. In-depth analysis showed that in 24 (48 eyes) \leq of the present study, the uncorrected vision of each eye individually was \leq 0.3. Of these patients, 58.4% did not wear glasses- not improving their baseline vision, which would classify them as visually impaired. This visual acuity is inconsistent with legal requirements in our country. However, with correction, they would eventually increase their vision in at least one eye. The detailed data showed that 75% of these 24 respondents with very low vision had not had eye surgery. Assuming that a proportion of those with cataracts would have surgery, they would also increase their visual acuity. This low vision (in the 24) was accompanied in 20.8% by positive responses for having suffered a car accident, in 58.3% – by difficulty driving only at night, and in 12.5% – by difficulty in general. These results differed significantly from the results of all respondents given below.

Data from the specific questions are presented in Fig. 2. Notably, the patients self-identified as healthy - no Daltonism, spectacles, surgery, or visual field involvement.

Almost all respondents reported that they drove a car. Only three did not drive, and the majority (50.9%) had no difficulty driving. Of these, however, 42.15% reported having difficulty driving in the dark, and 6.8% always had problems driving (Fig. 3).

The distribution by diagnosis is shown in Fig. 4. Those listed are socially significant eye diseases affecting central and peripheral vision. Glaucoma

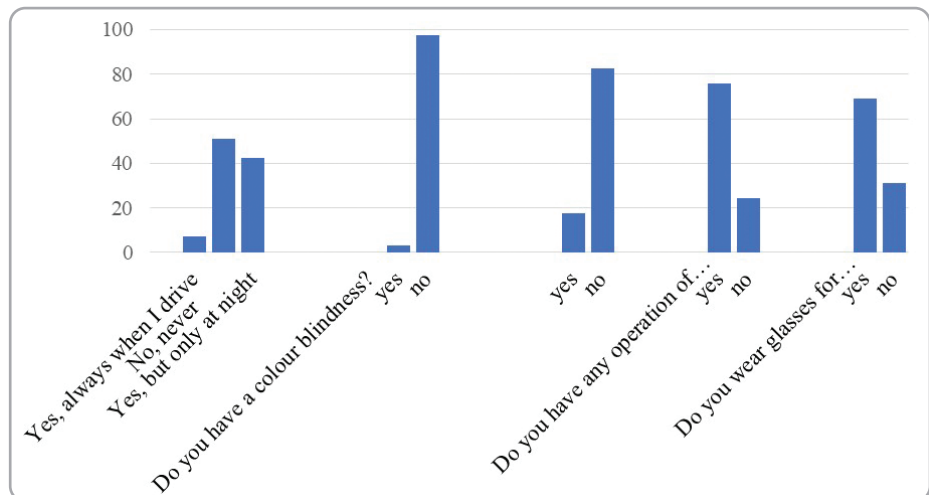


Figure 2. Results of specific questions.

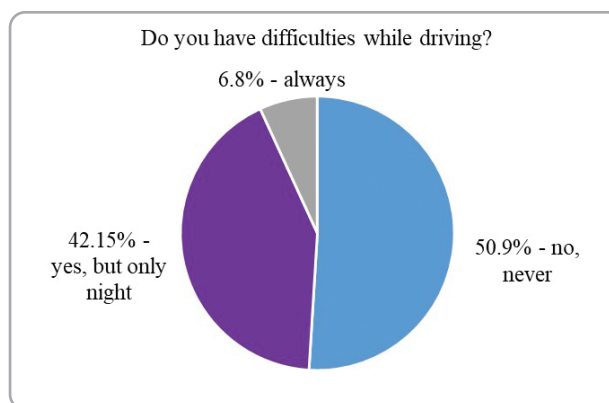


Figure 3. Results of the question about visual difficulties while driving.

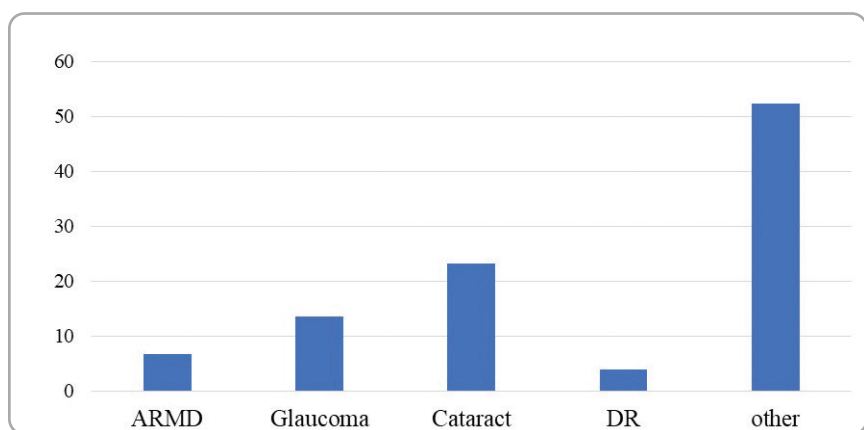


Figure 4. "What eye diagnosis do you have?" – a number of patients by diagnosis.

narrows the visual field in advanced stages, and age-related macular degeneration (AMD) severely impairs the central vision. Refractive errors were often concentrated in the "other" response – 54 people. However, 71 respondents answered that they did not wear glasses.

Apart from the quality of vision and diagnosis, it is interesting that there was a complete overlap in the results of the questions on whether the patient had

had a car accident, with positive responses in 13.7%, and whether they had ever had a stroke.

The results of the questions regarding whether the patients had a subjective feeling of visual field disturbance showed positive answers from 80% of the respondents. This result almost overlapped with 85% of them, reporting an objective visual field loss. Several older patients did not answer these questions, probably due to a misunderstanding. The same result was observed on the 12th question, asking whether they suffered from a CNS disease.

Discussion

The basic standard for obtaining a driving licence is vision, in its entirety – central and peripheral, despite its insufficiency to predict driving ability. However, the patient's general neuropsychiatric condition, multiple illnesses, an MLEC decision, and age and experience are equally important. In Bulgaria, data about visually impaired and blind patients are incomplete, as there are no accurate registers. According to www.atlas.japb.org, there were more than 45 thousand blind people in 2020 – 17 957 men и 27 820 women. Although the numbers have decreased over the last 30 years, they are still high.

There are about 20,000 visually impaired people, but the statistics are indicative. A part of them, even with MLEC solutions, drive their cars. Often, all ophthalmologists have convinced us how poorly sighted patients would come to be examined to the examination while driving their cars. Many studies have reported that patients had a visual acuity lower than required to acquire a motor vehicle license. For example, of all the drivers studied by Keeffe et al. 2002, 2.6% had insufficient visual acuity for a driving license. Moreover, the mean age of the patients was 62.5 years (range 44–101), as in our study, where 50–70-year-old drivers predominated.

A study by Levecq et al. was more extensive and involved 1000 patients (447 women and 553 men) with an average age of 71 years (Levecq et al. 2012). Of them, 810 were current drivers. Of these, 732 (90.4%) had visual acuity better than or equal to 20/40; in 78 (9.6%), it was worse. Of the remaining, 190 did not drive, and 47 (24.7%) had stopped driving due to poor vision. In a Polish study (Laudańska-Olszewska et al. 2011), 63 drivers aged 60 years or older were examined for distance vision, colour perception, and the visual field. The results showed that 11% did not meet the minimum requirements of the law, and 29% of the patients showed satisfactory results with optical correction but usually drove without it. The most common causes of reduced vision were ametropia (83%), AMD (7%), cataracts (6%), and glaucoma (4%). In our study, the data did not differ significantly.

A prospective analysis of 100 patients from Austria and Germany (Emesz et al. 2001) compared the results of vision testing of patients with retinal diseases and the minimum legal requirements needed for a driving licence. The results showed that 31 patients drove with less than the required visual acuity. Of the 50 patients with DR, 26 drove without meeting the minimum requirements. The mean age of the “illegal” drivers was 66.2 years.

An inquiry has been carried out in 369 ophthalmology practices about the number of patients driving their cars without meeting the minimum requirements for a West German Class 3 driver's licence. The data collected in the Harms survey was for 471 such patients in 2008 (Harms et al. 1984). Half of

these patients were younger than 62. The most common cause of reduced vision was age. In the younger group, the main cause was a refractive error that could be corrected, and in the older group, the main cause was cataract. Two-thirds of the patients studied believed that their vision was sufficient or good enough for driving. In contrast, younger patients were more self-critical than the older ones. Only 31% of the patients stopped night driving by their own judgement, while the rest continued despite their insufficient vision.

Many studies have examined the factor of peripheral vision in the analysis of driving skills. For example, Piyasena et al. 2021 found an association between visual impairment and the occurrence of traffic accidents. In 15,394 subjects with a mean age of 39.3 years, the prevalence of visual impairment ranged from 1.2%–26.4%, colour perception impairment from 0.5–17.1%, visual field impairment at 2.0–37.3%. Meta-analysis revealed a 46% higher risk of road traffic accidents in people with central vision impairment, 36% in people with colour perception impairment and 36% in the presence of visual field defects. Retrospective study by Rubin et al. 2007 concluded that examining central vision alone at driver's license renewal examinations may result in significant problems being missed. Attention should therefore be paid to contrast sensitivity, stereo vision and visual field. Bronstad's results are similar (Bronstad et al. 2013) – how loss of central visual field affects reaction time to pedestrians and delays detection of threats approaching from that side.

Many colleagues in our community believe that reporting patients who are unsafe to drive puts them in conflict and has negative consequences for patients, their families, and the patient-physician relationship. These ethical issues are addressed in Raymond W Jang's study analysing data from 1000 Canadian general practitioners (Jang et al. 2007).

Despite this, almost three-quarters of respondents agreed that doctors should be legally obliged to report patients with sight problems who do not meet the requirements to drive.

Conclusion

A person may be certified as a driver if he or she is fit to drive-has passed a driving test, and meets the vision requirements-has passed an examination in the appropriate country. The problem should not be viewed in a single layered way, because the ability to drive is a multifactorial process in which vision plays an undeniable role. Visual acuity must be reflected adequately without and with correction, complemented by peripheral vision and colour perception. The next step is to comply with the prescription for vision, i.e. the need for correction – spectacles, lenses or special aids - must be reflected in the relevant driving licence. Lastly, it must be observed when checking whether all of this is being done. This is not the end of the problem, because there must also be an adequate assessment of the driver's neuro-mental state, as well as an age limit for driving. MLEC and TRMEC committees to uncompromisingly restrict visually impaired drivers, and family physicians to report any change in patient status endangering safe driving. All of these complex efforts would crown a major "good vision-good driver" campaign with success. The present survey demonstrates the need for all of this because it shows patients driving with poor visual abilities, at not young ages, who overestimate their general and visual objective status.

References

- Bronstad PM, Bowers AR, Albu A, Goldstein R, Peli E (2013) Driving with central field loss I: effect of central scotomas on responses to hazards. *JAMA Ophthalmology* 131: 303–309. <https://doi.org/10.1001/jamaophthalmol.2013.1443>
- Emesz M, Egger SF, Nitsch S, Ruckhofer J, Hitzl W, Grabner G (2001) Kraftfahrzeuglenker mit Netzhautleiden - eine prospektive Studie1. *Klinische Monatsblätter für Augenheilkunde* 218: 670–676. <https://doi.org/10.1055/s-2001-18389>
- Harms H, Kröner B, Dannheim R (1984) Augenärztliche Erfahrungen bei Kraftfahrern mit unzureichender Sehschärfe*. *Klinische Monatsblätter für Augenheilkunde* 185: 77–85. <https://doi.org/10.1055/s-2008-1054574>
- Jang RW, Man-Son-Hing M, Molnar FJ, Hogan DB, Marshall SC, Auger J, Graham ID, Korner-Bitensky N, Tomlinson G, Kowgier ME, Naglie G (2007) Family physicians' attitudes and practices regarding assessments of medical fitness to drive in older persons. *Journal of General Internal Medicine* 22: 531–543. <https://doi.org/10.1007/s11606-006-0043-x>
- Keeffe JE, Jin CF, Weih LM, McCarty CA, Taylor HR (2002) Vision impairment and older drivers: who's driving? *The British Journal of Ophthalmology* 86: 1118–1121. <https://doi.org/10.1136/bjo.86.10.1118>
- Laudańska-Olszewska I, Biesiadzka M, Omulecka M (2011) [Ophthalmological assessment of driving ability of drivers at the age more than 60 years]. *Klin Oczna*. 113(4–6): 156–160.
- Levecq L, De Potter P, Jamart J (2012) Visual acuity and factors influencing automobile driving status in 1,000 patients age 60 and older. *Graefes Archive for Clinical and Experimental Ophthalmology* 251: 881–887. <https://doi.org/10.1007/s00417-012-2146-x>
- Piyasena P, Olvera-Herrera VO, Chan VF, Clarke M, Wright DM, MacKenzie G, Virgili G, Congdon N (2021) Vision impairment and traffic safety outcomes in low-income and middle-income countries: a systematic review and meta-analysis. *The Lancet Global Health* 9: e1411–e1422. [https://doi.org/10.1016/S2214-109X\(21\)00303-X](https://doi.org/10.1016/S2214-109X(21)00303-X)
- Regulation No. 3 (2011) Regulation No. 3 of May 11, 2011 on the physical fitness requirements for motor vehicle drivers and the conditions and procedure for carrying out the medical examinations to determine the physical fitness for drivers of the different categories. *State Gazette No 19/20.05.2011*. <https://dv.parliament.bg/DVWeb/show-MaterialDV.jsp?idMat=50195>
- Rubin GS, Ng ESW, Bandeen-Roche K, Keyl PM, Freeman EE, West SK (2007) A prospective, population-based study of the role of visual impairment in motor vehicle crashes among older drivers: The SEE Study. *Investigative Ophthalmology & Visual Science* 48: 1483. <https://doi.org/10.1167/iovs.06-0474>
- Sebo P (2020) Physicians' views on the usefulness of practical tools for assessing the driving ability of older drivers: a cross-sectional study. *Family Medicine and Community Health* 8: e000332. <https://doi.org/10.1136/fmch-2020-000332>