

National Consensus on the Assessment of Visual Function for Driving in Switzerland

Nationaler Konsens über die verkehrsmedizinische Beurteilung der Sehfunktion in der Schweiz



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ABSTRACT

Purpose To establish a national consensus on assessing visual function for fitness to drive in Switzerland.

Methods The minimum medical requirements for visual function for fitness to drive are regulated by Swiss Federal Law, namely, by the Traffic Licensing Ordinance (TLO). The medical examination techniques relevant in this context and their assessment are not further specified therein, which leads to legal inequality among drivers and uncertainty among examiners. We established a study group of representatives of the Traffic Medicine Section of the Swiss Society of Forensic Medicine and the Traffic Commission of the Swiss Society of Ophthalmology to develop a national consensus on assessing visual function for fitness to drive in Switzerland. In structured meetings, the authors discussed medical examination techniques and available international and local recommendations on this topic, with respect to Swiss legislation. In the event of a contrary opinion, the topic was discussed again in a follow-up session until we reached an agreement. We defined consensus as complete agreement on the subject under discussion.

Results The study group held five in-person meetings between March 2019 and January 2023. The authors developed recommendations intended for all professional groups assessing driving fitness. We prepared an aid for daily practice on how to examine the minimum medical requirements for visual function listed in the TLO Annex 1, using standardized test procedures and considered how to interpret the findings obtained, accounting for aspects of traffic medicine and ophthalmology.

Conclusions A consensus on the assessment of visual function for fitness to drive in Switzerland is crucial to ensure legal equality for drivers and legal certainty for examiners. Regular review of the consensus is imperative if we are to consider future legal developments and new scientific evidence in assessing fitness to drive.

ZUSAMMENFASSUNG

Hintergrund Erarbeitung eines nationalen Konsenses zur Beurteilung der Sehfunktion für die Fahreignung in der Schweiz.

Methoden Die medizinischen Mindestanforderungen an die Sehfunktion im Hinblick auf die Fahreignung sind im Schweizer Bundesrecht, namentlich in der Verkehrszulassungsverordnung (VZV), geregelt. Die in diesem Zusammenhang relevanten medizinischen Untersuchungstechniken und deren Beurteilung sind darin nicht weiter spezifiziert, was zu Rechtsungleichheit bei den Fahrzeuglenkern und Unsicherheit bei den Untersuchern führt. Wir haben eine Arbeitsgruppe aus Vertretern der Sektion Verkehrsmedizin der Schweizerischen Gesellschaft für Rechtsmedizin und der Verkehrskommission der Schweizerischen Gesellschaft für Ophthalmologie gegründet, um einen nationalen Konsens zur Beurteilung der Sehfunktion für die Fahreignung in der Schweiz zu entwickeln. In strukturierten Sitzungen diskutierten die Autoren medizinische Untersuchungstechniken und verfügbare internationale

und lokale Empfehlungen zu diesem Thema unter Berücksichtigung der Schweizer Gesetzgebung. Im Falle einer gegenteiligen Meinung wurde das Thema in einer Folgesitzung erneut diskutiert, bis eine Einigung erzielt werden konnte. Wir definierten einen Konsens als vollständige Übereinstimmung über das diskutierte Thema.

Ergebnisse Die Studiengruppe hielt zwischen März 2019 und Januar 2023 5 persönliche Sitzungen ab. Die Autoren erarbeiteten Empfehlungen, die sich an alle Berufsgruppen richten, welche die Fahreignung beurteilen. Für die tägliche Praxis wurde eine Hilfestellung erarbeitet, wie die im Anhang 1 der VZV aufgeführten medizinischen Mindestanforderungen an die Sehfunktion mit standardisierten Testverfahren überprüft und die gewonnenen Ergebnisse unter Berücksichtigung verkehrsmedizinischer und augenärztlicher Aspekte interpretiert werden können.

Schlussfolgerungen Ein Konsens über die Beurteilung der Sehfunktion für die Fahreignung in der Schweiz ist von entscheidender Bedeutung, um die Rechtsgleichheit für die Fahrzeugführer und die Rechtssicherheit für die Untersucher zu gewährleisten. Eine regelmäßige Überprüfung des Konsenses ist unerlässlich, um zukünftige rechtliche Entwicklungen und neue wissenschaftliche Erkenntnisse bei der Beurteilung der Fahrtauglichkeit zu berücksichtigen.


Introduction

Good health is a prerequisite for safe driving. As health may decline with age, special attention must be paid to the driving fitness of older people. The aging population worldwide is also observed in Switzerland, where one-fifth of the country is over 65 years old [1, 2]. The increasing life expectancy and the low birth rates further exacerbate the situation [2]. Meanwhile, the Federal Statistical Office in Switzerland reported on national mobility behavior in 2021, where the average daily driving distance per person was around 30 kilometers, and 78% of households owned a car [3]. Hence, we expect an inevitable increase in older drivers accustomed to car-based mobility. In addition, access to a car enables older people to participate in a social life outside their home, which ultimately positively impacts their quality of life and health [4, 5].

An expert panel, the Eyesight Working Group, developed the basis for the current European regulations on visual competence to drive [6–8]. Each member state of the European Union may impose stricter requirements without neglecting the minimum standard [8]. In Switzerland, the Traffic Licensing Ordinance (TLO) adopted by the Swiss Federal Council in the Swiss Federal Law defines the licensing of drivers and vehicles for road traffic [9]. In 2016, a comprehensive revision of the TLO aligned the national guidelines with the European minimum medical requirements, with the Swiss version containing few adjustments. One of the main impacts of the revision involved merging the previously defined three medical groups within the national legislation into two groups according to the European standard. ► **Figs. 1** and **2** further explain the mentioned revision. The TLO further regu-

lates the requirements and responsibilities of medical physicians regarding traffic medical examinations. In short, necessary traffic medical assessments are required to obtain any driving license. In-depth investigations are required for professional passenger transport licenses, for drivers of trucks or buses with more than eight seats, for persons with profound physical disabilities or impairments, for the issuing of expert opinions on fitness to drive and driving ability, and also for persons aged 75 and over [9]. The mentioned age group holding a driver's license for private cars must undergo biyearly assessments on their fitness to drive, a so-called level 1 medical examination [9]. This includes an extended medical history of medication intake, substance abuse, or relevant symptoms of mental or metabolic disorders, as well as a physical examination of the eyes, skin, nervous, cardiovascular, pulmonary, and abdominal systems, and the musculoskeletal system [9]. In general, the focus lies on the level of functioning rather than the medical diagnoses themselves. However, the medical examination techniques relevant in this context and their assessment are not further specified therein, which leads to legal inequality among drivers and uncertainty among examiners.

To achieve a national consensus on the traffic medical examination regarding visual competence, the Traffic Medicine Section of the Swiss Society of Forensic Medicine and the Traffic Commission of the Swiss Society of Ophthalmology have collaborated as a working group. This manuscript provides the established consensus effort on assessing visual function for driving in Switzerland.

Group 1	Group 2	Group 3
Corrected visual acuity: - Better eye minimum 1.0 - Poorer eye minimum 0.8 - Refraction limits	Corrected visual acuity: - Both eyes minimum 0.8 or - Better eye minimum 1.0 - Poorer eye minimum 0.6	Corrected visual acuity: - Better eye minimum 0.6 - Poorer eye minimum 0.1 or - Better eye minimum 0.8
2016: Revision of the Traffic License Ordinance		Monocular vision: - Corrected visual acuity 0.8 minimum
Criteria based on European Directive 2009/113/EC 		
Group 1 Corrected visual acuity: 0.5 binocular EU - Better eye minimum 0.5 EU - Poorer eye minimum 0.2	Group 2 Corrected visual acuity: - Better eye minimum 0.8 - Poorer eye minimum 0.5 0.1 EU	
Monocular vision: - Corrected visual acuity 0.6 0.5 minimum		

► **Fig. 1** Illustration of the 2016 Swiss Traffic Licensing Ordinance revision to harmonize the Swiss guidelines (depicted above) with the European standard (depicted below) regarding the visual acuity assessment for fitness to drive. The previously defined three medical groups in the Swiss legislation were merged into two groups according to the European standard. Group 1 describes drivers of motorcycles, bicycles, cars under 3500 kilograms and with no more than eight seats, tractors, agricultural vehicles, bicycles, and minibuses under 3500 kilograms. Group 2 describes drivers of trucks, buses over 3500 kilograms, professionals seeking passenger transport licenses, or for traffic experts. A more detailed group description may be found in the Swiss Traffic Licensing Ordinance [9]. The Swiss adjustments compared to the European standard are marked in blue.

Methods

The working group aimed at reaching a national consensus on the assessment of visual function for driving. It was comprised of experienced traffic medicine experts and ophthalmologists with a clinical track record of evaluating visual function (e.g., glaucoma specialists, neuro-ophthalmologists, electrophysiologists, strabismus specialists). Further criteria included the availability to attend the consensus meetings, a geographical and linguistic representation of the three major language regions of Switzerland, and a manageable number of members in order to be able to conduct a constructive discussion. Except for study authors S.S. and S.A.Z., all authors participated in and contributed considerably to the consensus meetings without receiving any honoraria for their work. Ethical approval was not required as the consensus process does not fall within the scope of the Human Research Act.

Between March 2019 and January 2023, the consensus group held five in-person meetings, with subgroups continuing to work on specific topics in between to prepare for the next group gathering. The consensus group discussed the legal and theoretical basis for assessing fitness to drive, critically reviewing available international and local recommendations while considering Swiss legislation. However, the main focus was on the practical methodology. In prepared sessions, the group defined the following topics to be questioned: visual acuity testing, visual field testing,

visual field interpretation, assessment of mesopic vision and sensitivity to light, ocular motility testing, and examination of double vision. We defined consensus as complete agreement on the subject under discussion. If no consensus was reached, the group held follow-up meetings to address outstanding issues and propose solutions. The group documented all meetings in the form of protocols. In addition, the group purposefully invited external experts and authorities to advise the consensus meetings, including representatives of the Swiss Federal Roads Office, perimetry device manufacturers, and representatives of the Traffic Commission of the German Society of Ophthalmology. Further experts from the United Kingdom, Sweden, and Norway contributed in an advisory capacity. The consensus meetings came to an end after complete agreement among all parties present was reached.

Results

The final recommendations mentioned below for the assessment of visual function for driving in Switzerland represents 100% agreement among the consensus study group. The authors' recommendations are intended for all professional groups assessing driving fitness. The final judgment should not solely include the vision aspect alone but instead consider all minimum medical requirements, which are listed in the TLO [9].

Group 1	Group 2	Group 3
No visual field restriction No higher grade ptosis	No visual field restriction	Horizontal visual field $\geq 140^\circ$
No monocular vision		Monocular vision: - No visual field restriction

2016: Revision of the Traffic License Ordinance

Group 1	Group 2
- Horizontal visual field $\geq 120^\circ$ Extension to the right and left $\geq 50^\circ$ - Extension up and down $\geq 20^\circ$ - Normal within a radius $\geq 20^\circ$	- Horizontal visual field $\geq 140^\circ$ 160° EU Extension to the right and left $\geq 70^\circ$ - Extension up and down $\geq 30^\circ$ - Normal within a radius $\geq 30^\circ$ on both eyes (monocularly tested)
Monocular vision: - No visual field restriction and No motility disorder	No monocular vision

Criteria based on European Directive 2009/113/EC

► **Fig. 2** Illustration of the 2016 Swiss Traffic Licensing Ordinance revision to harmonize the Swiss guidelines (depicted above) with the European standard (depicted below) regarding the visual field assessment for fitness to drive. The previously defined three medical groups in the Swiss legislation were merged into two groups according to the European standard. Group 1 describes drivers of motorcycles, bicycles, cars under 3500 kilograms and with no more than eight seats, tractors, agricultural vehicles, bicycles, and minibuses under 3500 kilograms. Group 2 describes drivers of trucks, buses over 3500 kilograms, professionals seeking passenger transport licenses, or for traffic experts. A more detailed group description may be found in the Swiss Traffic Licensing Ordinance [9]. The Swiss adjustments compared to the European standard are marked in blue.

Legal basis

► **Table 1** provides an overview of the minimal vision requirements regarding driving fitness. If the visual acuity values are only achieved with a visual aid, one must wear it while driving. In the event of a new onset of monocular vision, one must adhere to a 4-month driving cessation, submit a report by an ophthalmologist, and pass a driving test with a traffic expert [9]. Irrespective of the medical reporting law, a doctor is obliged to inform the patient about his or her fitness to drive. This is part of the safety disclosure, which, according to the Swiss Code of Obligations, is based on the contractual relationship between doctor and patient. Please refer to the corresponding articles in the Road Traffic Act and the Traffic Licensing Ordinance for further information on the legal basis [9, 10].

Practical approach

Visual acuity

Visual acuity may be tested using validated visual acuity charts, visual acuity testing systems, or visual charts projectors, whereby the test conditions (e.g., distance, lighting) must be strictly adhered to. Snellen E-charts and Landolt rings are the standards for traffic medical visual acuity assessment. The reading speed should be approximately one visual symbol per second. A visual acuity level is achieved if 60% of the visual symbols of a line are correctly recognized. Specifications such as p (partial) or pp (partim-partial) are not permitted. The assessment of fitness to drive is based

strictly on the distance limits specified in the minimum requirements.

Visual field

Visual field testing: The visual field is tested monocularly using the confrontation method, with the following exceptions. An instrumental visual field test must be carried out in the following situations: indications of visual field defects when testing the visual field using the confrontation method; known diseases that may be associated with visual field defects; previously known visual field defects; suspected visual field defects due to previous traffic history (e.g., accidents).

The standard method for instrumental visual field testing regarding the fitness to drive is the static perimetry for the central 20 degrees (first medical group) or 30 degrees (second medical group), and the kinetic perimetry to determine the outer visual field borders. The examination is performed monocularly. For static perimetry, a device similar to the Octopus perimeter (Haag Streit AG, K oniz, Switzerland) or the Humphrey perimeter (Carl Zeiss AG, Jena, Germany) should be used. A sufficiently accurate threshold-determining strategy analogous to the normal or dynamic (Octopus) or the SITA strategy (Humphrey Perimeter) should be used. Rapid test strategies such as the TOP strategy (Octopus) are used for screening purposes and are, therefore, not suitable for accurate threshold determination and traffic medical assessment of the visual field. A sufficiently dense test grid

► **Table 1** Overview of the minimal visual function requirements listed in the Swiss Traffic Licensing Ordinance regarding driving fitness. Visual acuity is provided in Snellen decimals. Group 1 describes drivers of motorcycles, bicycles, cars under 3500 kilograms and with no more than eight seats, tractors, agricultural vehicles, bicycles, and minibuses under 3500 kilograms. Group 2 describes drivers of trucks, buses over 3500 kilograms, professionals seeking passenger transport licenses, or for traffic experts. A more detailed group description may be found in the Swiss Traffic Licensing Ordinance [9].

	Group 1	Group 2
Distance visual acuity	Binocular vision: Better eye: 0.5 Worse eye: 0.2 (measured separately).	Binocular vision: Better eye: 0.8 Worse eye: 0.5 (measured separately).
	Monocular vision: (including visual acuity if worse eye < 0.2): 0.6	
Visual field	Binocular vision: Horizontal field of vision of at least 120 degrees. Extension to the right and left of at least 50 degrees. Extension upwards and downwards of at least 20 degrees. Normal central field of vision of up to 20 degrees.	Binocular vision: Horizontal field of vision of at least 140 degrees. Extension to the right and left of at least 70 degrees. Extension upwards and downwards of at least 30 degrees. Normal central field of vision of up to 30 degrees in each eye.
	Monocular vision: Normal visual field with normal eye movements.	
Eye movements/ double vision	No restricting double vision.	Normal eye movements (no double vision).
Mesopic vision and sensitivity to light	No significant impairment of mesopic vision.	No significant impairment of mesopic vision.
	No significantly increased sensitivity to light.	No significantly increased sensitivity to light.

should be used for the test program, e.g., a “glaucoma program” such as G2 (Octopus) or 24–2 (Humphrey Perimeter). The examiner must ensure that the visual field examination is of sufficient quality and conclusive based on the fixation control and the false-positive and false-negative rates. If the false-positive rate or the loss of fixation exceeds 15%, the examination is not usable. A limit of 30% applies for false-negative questions. The visual field’s outer borders are determined kinetically (Goldmann/Goldmann module) and monocularly using test mark III/4e, which is moved at a maximum of 5 degrees per second. Automatic Goldmann perimetry methods may be applied. A sufficient number of static control points must be tested in the visual field area between the central 20–30 degrees and the outer borders determined by kinetic perimetry so that larger peripheral visual field defects are recognized in this area. The classification of degrees in static and kinetic perimetry refers to the radius. Other perimetry procedures can be performed if they meet the requirements.

Visual field interpretation in the first medical group: The following are still considered “normal” according to the TLO [9]:

- MD (mean defect) ≤ 10 dB (the smaller value of both eyes is decisive) and
- no defects > 10 dB for the central 10 degrees of the visual field. In the area between 10 and 20 degrees, a maximum of three defects > 10 dB are allowed. A maximum of two defects may be adjoining (► Fig. 3).

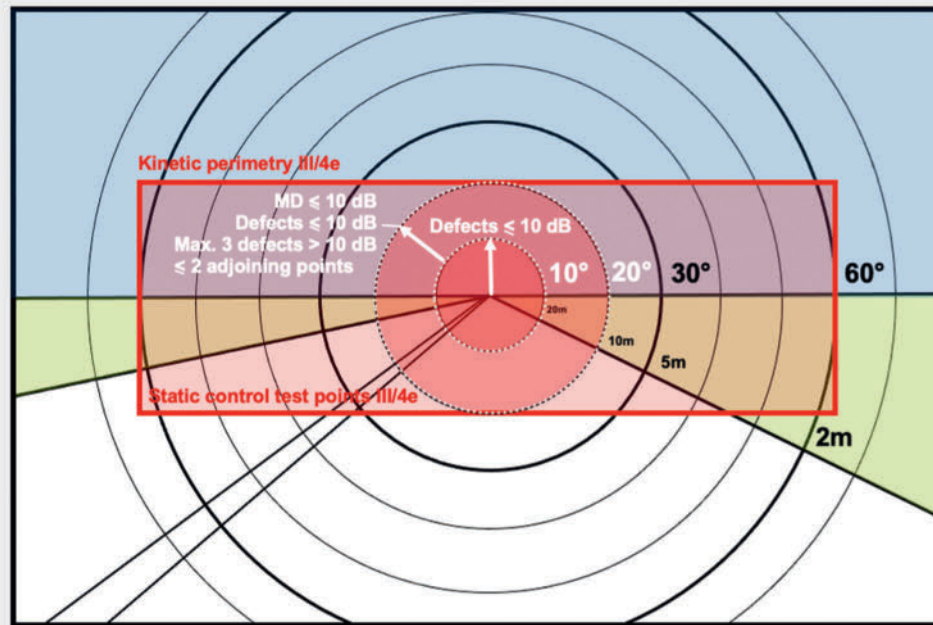
The horizontal visual field extension measured on the horizontal midline must be 120 degrees without any interruption. The extension to the right, left, or up and down mentioned in the TLO must

be present [9]. The binocular visual field is decisive in traffic medicine. The central visual field is assessed by integrating the findings from the two monocular visual fields. Alternatively, the visual field may be tested using a simultaneous binocular method. Monocular patients must have a normal central visual field as defined above (except the blind spot as a physiological scotoma) and a horizontal visual field extension of at least 120 degrees without interruption, measured on the horizontal midline. The blind spot must not be enlarged.

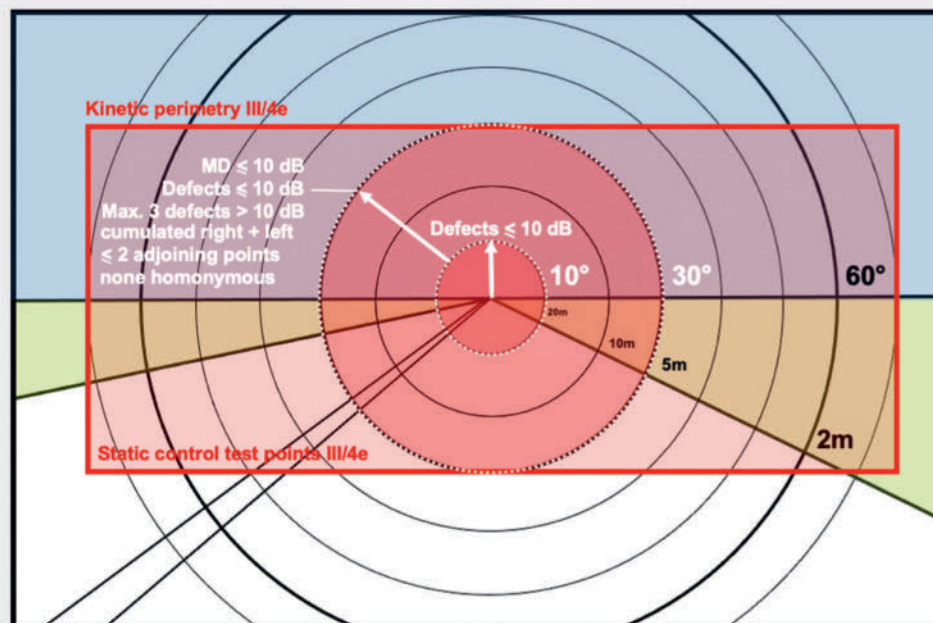
Visual field interpretation in the second medical group: The central visual field must be normal up to 30 degrees in both eyes, measured monocularly. Binocular compensation of a defect must not be considered in the assessment. The following are still considered “normal” according to the TLO [9]:

- MD (mean defect) ≤ 10 dB (applies to each eye measured individually) and
- no defects > 10 dB for the central 10 degrees of the visual field. In the area between 10 and 30 degrees, a maximum of three defects > 10 dB cumulated on the right and left are allowed. A maximum of two defects may be adjoining, with no homonymous defects > 10 dB (► Fig. 4).

The horizontal visual field extension measured on the horizontal midline must be 140 degrees without any interruption. The extension to the right, left, or up and down mentioned in the TLO must be present [9].



► **Fig. 3** Visual field assessment for fitness to drive in the first medical group according to the Traffic Licensing Ordinance [9]. The binocular visual field is decisive, whereby the central visual field is assessed by integrating the findings from the two monocular visual fields. Alternatively, the visual field may be tested using a simultaneous binocular method. The horizontal visual field extension measured on the horizontal midline must be 120 degrees without any interruption.



► **Fig. 4** Visual field assessment for fitness to drive in the second medical group according to the Traffic Licensing Ordinance [9]. The central visual field must be normal up to 30 degrees in both eyes, measured monocularly. Binocular compensation of a defect must not be considered in the assessment. The horizontal visual field extension measured on the horizontal midline must be 140 degrees without any interruption.

Double Vision

Double vision must be explicitly inquired. If double vision is suspected, an ophthalmological examination must be carried out. The ophthalmologist must determine the visual field free of double vision. The double vision-free visual field is determined with the head held straight (maximum deviation 10 degrees).

Interpretation of double vision: A driving cessation period of 3 months must be observed after the new occurrence of double vision, which is compatible with fitness to drive.

- First medical group: If double vision is present, a binocular visual field free of double vision in the central 20 degrees diameter is required.
- Second medical group: Double vision (except in extreme positions) is not permitted. The exception are holders (not new applicants) who may retain their driving license in the event of newly occurring double vision if they have a double vision-free visual field of 25 degrees when looking up, 40 degrees when looking down, and 30 degrees when looking sideways.

Mesopic vision and sensitivity to light

Mesopic contrast vision and sensitivity to light are assessed based on an overall view of the patient's personal and third-party anamnestic data, existing eye changes/diseases, and traffic history. In unclear and/or controversial cases, mesopic vision with/without glare testing can be performed using appropriate equipment.

Interpretation of mesopic vision and sensitivity to light: If there is a significant impairment of mesopic vision and/or a significantly increased light sensitivity, a level 4 doctor (traffic physician of the Swiss Society of Forensic Medicine) may recommend a night driving ban [9]. In the instrumental test of mesopic contrast vision, at least the following contrast levels must be recognizable without/with glare testing:

- Medical group 1: 1:2.3;
- Medical group 2 (without the categories D, D1): 1:5;
- Categories D and D1 (according to the Swiss vehicle license categories [11]): 1:2.7.

Further aspects

Stereo vision: Stereo vision does not have to be tested as there are no minimum requirements.

Color vision: Color vision does not have to be tested. No legal regulation excludes color vision deficient or color-blind people from traffic and inland navigation.

Discussion

This manuscript presents the national consensus on the traffic medical examination regarding the assessment of visual function for driving in Switzerland. The reached consensus was presented to the boards of the Swiss Society of Ophthalmology and the Traffic Medicine Section of the Swiss Society of Forensic Medicine. After their approval, we translated the standard into all three national languages (i.e., German, French, and Italian), allowing it to come into force as a guideline of the two specialist societies on September 1, 2023.

In the health care system, rulings at a nationwide level may significantly impact the population's well-being. The difficulty is that

sometimes, decisions must be made even if there is insufficient objective evidence to provide legal guidance [12]. However, to avoid health inequalities, a consensus process is more sustainable than informal group decisions, which may be biased by a power imbalance within the group or suffer from an unstructured decision-making process [12, 13]. Despite largely standardized minimum medical requirements in Europe [8], the need for a Swiss consensus arose as there are still differences across the countries, mainly in documenting visual fields and their interpretation. One of the main discrepancies between the Swiss and European minimum medical requirements is that the TLO requests that the second medical group demonstrate a normal central visual field for each eye, whereas according to the European Directive 2009/113/EC, only the binocular central visual field must be normal and therefore may be binocularly compensated [8, 9]. Hence, the Swiss legal interpretation is more stringent. Whether this is more reasonable regarding traffic safety requires scientific analyses of the various perimetry standards based on specific practical cases.

The primary challenge in compiling the Swiss consensus concerned the perimetry and its interpretation. Our aim was to avoid the introduction of a new perimetry program and instead use existing standard examinations, such as threshold perimetry with glaucoma programs in the center and kinetic perimetry for the outer borders, as had been used previously in the Swiss assessment prior to the 2016 TLO revision. The Swiss Society of Forensic Medicine had recommended the kinetic determination of the outer visual field borders, as this theoretically comes closer to a real traffic situation than the static assessment. Indeed, the literature extensively reported a phenomenon called statokinetic dissociation (SKD), which occurs not only in visual pathway disorders but may also be found in healthy subjects as a physiologic finding [14, 15]. The SKD describes the sensitivity discordance between static and kinetic visual field stimuli, which may be due to differences in the processing of static and kinetic inputs, beginning on a retinal level [16, 17]. Hypotheses such as the partially separate stimulation of retinal cells of magnocellular (more sensitive to high temporal and low spatial frequencies) and parvocellular (more sensitive to low temporal and high spatial frequencies) systems may explain this finding [15, 16]. Whether assessing this phenomenon leads to a lower probability of traffic accidents remains speculative. Preserving a combination of standard static and kinetic perimetry tests for assessing fitness to drive has the advantage that it can be performed on all common perimetry devices. However, the procedure is time-consuming and may be strenuous for the test subjects [18]. We encourage the industry to develop a test that can carry out these examinations in a single working process, which should be technically feasible.

Public consensus statements are generally snapshots in time, which reflect the current state of knowledge [19]. The joint working group on this manuscript meets at least once a year to consider experience and feedback from practical applications, developments in Swiss and European law, and advances in science. As guideline updates must be approved and published by the boards of the two specialist societies mentioned, subsequent versions are associated with greater expense and, therefore, are only planned if there is a greater need for revision. In the meantime, clarifying

statements may be published to provide flexible solutions to individual issues.

In summary, this manuscript reflects the consensus effort and provides the national guidelines for assessing visual function regarding fitness to drive. Medical professionals involved in assessing driving fitness may directly give feedback on practical aspects to the Traffic Medicine Section of the Swiss Society of Forensic Medicine or to the Traffic Commission of the Swiss Society of Ophthalmology. This consensus aimed to ensure legal equality for drivers and legal certainty for examiners. Regularly reviewing the consensus is imperative to consider future legal developments and new scientific evidence in assessing fitness to drive.

Conflict of Interest

The authors declare that they have no conflict of interest.

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