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EXECUTIVE SUMMARY

The elderly population in Canada continues to increase. Seniors represent the fastest growing population group in Canada and this is also the case in Ontario. Based on population projections from Statistics Canada, Human Resources and Skills Development Canada (2012) reported that in 2011 there was an estimated 5 million Canadians over the age of 65. The increase in the number of senior drivers is a cause for concern given that this group of drivers account for the second largest proportion of road deaths. For example, Canadian seniors (aged 65+) have the second highest motor vehicle death rate among licenced drivers, with an average of 15.7 deaths per 100,000 licenced drivers compared to 9.6 deaths for drivers aged 45-54. In 2010, there were 508,593 Ontario licenced drivers aged 75 and older, 12,568 of which had collisions that year. This translates to 247 collisions per 10,000 elderly drivers (MTO 2010). Older drivers are also at an increased risk of suffering from late-life cognitive impairment and dementia (Carr et al. 2006; Carr and Ott 2010; Dobbs 2005). These diseases are concerning as they can affect one’s ability to drive safely.

The identification and diagnosis of medical conditions that have the potential to affect driving performance has historically been left to healthcare professionals. Due to the increase in the number of licenced elderly drivers (a group which as a whole are more likely to suffer from a physical or cognitive impairment that may affect their driving), this may no longer be an option. Some jurisdictions have opted to implement age-based licence renewal processes in an effort to identify those drivers who present a heightened risk of collision.

Presently, the Ontario Ministry of Transportation (MTO) has a system in place to assess drivers with the goal of differentiating drivers who may be at greater risk of causing a crash from those who are not. Three driving programs have been developed to meet this end, two of which focus specifically on elderly drivers: the 70 and Older Collision Program and the 80 and Above Licence Renewal Program. The 80 and Above Licence Renewal Program (or GES) consists of five elements that are used for screening elderly drivers which include a review of demerit points on the driving record, a vision test, attendance and participation in GES, a written knowledge test on road rules/signs and traffic safety, and an on-road test (only if deemed necessary).

The challenge that MTO currently faces is the lack of a reliable way to assess whether drivers suffer from cognitive impairments. In order to address this problem, it would be helpful to incorporate a screening element into the current GES framework which will accurately indicate the presence of cognitive impairments that compromise fitness to drive and assist Driver Improvement Counsellors (DICs) to make informed road test referral decisions.

The objective of this project is to gather and analyze information to inform the selection of a cognitive screening tool(s) that can be pilot-tested for use during GES. In order to accomplish this objective, a meta-analysis of the literature on cognitive screening tools (Phase 1) and a review of GES and a best practices review of elderly driver programs internationally (Phase 2) were conducted. The third phase is a synthesis of the Phase 1 and Phase 2 results and is the subject of
this report. Based on this synthesis, the effectiveness of the selected cognitive screening tools is weighed against the implementation considerations and criteria identified through the GES review to identify which tools are most feasible to incorporate into GES and pilot test (Phase 4).

**Meta-analysis.** The meta-analysis consisted of a review of the literature which included 446 articles. From these, particular articles were selected based on relevance, i.e., whether they evaluated a cognitive tool. The number of tools selected from these evaluations totaled 42. These articles and their relevant tools were coded and entered into a database. Criteria were developed to ensure the tools would be applicable to the parameters of the GES (duration of tool, administration of tool, feasibility of administration, computer (versus paper-and-pencil), and expertise required to administer). Once applied, the criteria narrowed the list to ten cognitive screening tools that could be weighed against GES implementation considerations to determine their feasibility for inclusion in the pilot. The ten tools are:

- Maze Task Test;
- Rey-Osterrieth Complex Figure Test;
- Clock Drawing Test;
- Single Letter Cancellation Test;
- Double Letter Cancellation Test;
- Traffic Sign Recognition Test (TSRT);
- Charron Test
- Visual Form Discrimination Test;
- Wechsler Digit Symbol Substitution Test (DSST); and,
- Eight Item Informant Questionnaire.

The meta-analysis provided evidence suggesting that cognitive screening tools that meet MTO’s logistical requirements for GES (i.e., inclusion criteria were satisfied) can be used to predict driving performance. It was found that, on average, when cognitive screening tools predict a driver is unsafe, there is a 94% greater chance that this driver will exhibit unsafe driving behaviour, rather than safe driving behaviour (or, alternatively, if the cognitive screening tools predict that a driver is safe, on average, it is 94% more likely that this driver will exhibit safe driving behaviour, rather than unsafe driving behaviour).

**GES review.** The purpose of Phase 2 was to gather in-depth information regarding the current structure of the GES in order to provide an overview of its strengths and challenges and to determine the feasibility of the inclusion of a cognitive screening tool into the existing program framework. This includes the identification of potential implementation barriers as well as the identification of program modifications that need to be made to the current GES format, structure, and content to accommodate for the inclusion of a tool. To accomplish this, a review of all GES program material, observation of six GES sessions, survey of 64 senior GES participants, and key informant interviews with Field Services Managers (FSMs) were completed.

As a result of this review, implementation barriers were identified along with criteria for cognitive screening tool selection. These criteria were applied to the list of ten tools from the meta-analysis to identify the most appropriate cognitive screening tools for the pilot test.
1. Select a tool that requires limited training for DICs to administer, interpret, and score.
2. Select a tool that does not rely heavily on an understanding of the English language; in other words, the tool should use clear, concise language and instructions should be brief and easy to understand.
3. Take into account language and literacy barriers when selecting a tool.
4. Take into account the physical limitations of seniors when selecting a tool.
5. Select a tool that adheres to relatively strict time limits.
6. Select a tool with a high degree of consistency in scoring.
7. Take into account copyright fees or the cost to purchase and/or translate (if possible) certain tools.

**Best practices review.** The second component of Phase 2 was an environmental scan of elderly driver licence renewal programs internationally. An extensive internet search was conducted and researchers reached out to agencies, program administrators, and experts in the area of licencing in jurisdictions across the world including Canada, the United States, Western Europe, Australia, and New Zealand. The collected information was synthesized to identify common program structures and the frequency with which educational sessions and cognitive screening tools are incorporated into the re-licensing process for elderly drivers.

The environmental scan revealed that most jurisdictions do not include mandatory age-based screening for the purpose of licence renewal. Instead, programs or processes can be classified in one of the following three categories:

- Voluntary education courses and/or testing.
- Medical examination or assessment required if ‘cause for concern.’
- Mandatory examination and/or mandatory medical assessment.

The use of cognitive screening tools in a consistent fashion is rare with elderly driver licence renewal programs. While healthcare providers or occupational therapists may assess the cognitive functioning of some elderly drivers, few jurisdictions require the use of specific tools and fewer still require that all drivers undergo mandatory cognitive screening (some examples include Nova Scotia, Maryland, Denmark, and the Netherlands).

In comparison to international programs, Ontario’s licence renewal process for elderly drivers is unique, progressive, and comprehensive. There are very few programs which include an interactive education session which encourages participation and learning. Due to the fact that cognitive and physical impairments are more likely to be present in an older population, having the cut-off age for licence renewal set at 80 makes it less prone to potential political and public objections that are typically associated with age-based screening.

**Tool selection.** After taking into consideration the results from both the Phase 1 Meta-analysis and the Phase 2 GES Review, it is possible to make final recommendations regarding which tools are most feasible for MTO to pilot in Phase 4 of this project. Each of the ten cognitive screening tools has its own unique strength in predicting driving ability; moreover, sensitivity and specificity data were not available. Similarly each tool fits differently within the parameters of GES. As such, several of the top ten tools can be eliminated on account of their inability to meet the practical...
implementation criteria (listed above). These tools include the Rey-Osterrieth Complex Figure Test, the Traffic Recognition Test, the Charron Test, and the Eight Item Informant Interview.

Four tools had the best balance between safe driving predictive value and feasibility for inclusion in GES. Each of the following screening tools is equally suitable for administration in a group setting and meets a variety of practical implementation considerations. These are the tools recommended for use in the pilot testing phase along with the reasons for their selection:

- **Wechsler Digit Symbol Substitution Test**
  - High predictive value;
  - Sensitivity of 91.7% and a specificity of 81.2%;
  - Time limit is not overly restrictive;
  - Does not rely heavily on motor abilities of participants;
  - Easy to score and could be standardized;
  - Lack of subjectivity in scoring; and,
  - Little training required to administer and score.

- **Single Letter Cancellation Test/Double Letter Cancellation Test**
  - Significant ability in predicting driver behaviour;
  - Limited amount of time required to administer and score;
  - Does not rely heavily on motor abilities of participants;
  - Easy to administer;
  - Easy to score and could be standardized;
  - Lack of subjectivity in scoring; and,
  - Little training required to administer and score.

- **Visual Form Discrimination Test**
  - Overall predictive value as part of a group of tests was significant;
  - Does not rely heavily on motor abilities of participants;
  - Limited amount of time to administer and score;
  - Easy to administer;
  - Easy to score and could be standardized;
  - Lack of subjectivity in scoring; and,
  - Little training required to administer and score.

Two additional cognitive tools, the Maze Task Test and the Clock Drawing Test have higher predictive value and were considered for exclusion based on the concern of managers who believe there is the possibility that seniors with motor impairments might not be able to successfully complete them (which according to this perception, could potentially result in a false positive outcome). However, in the absence of evidence, the likely prevalence of such physical limitations is not clear. Furthermore, it can also be argued that having such a condition that causes a significant motor deficit could put older drivers at a heightened collision risk. As a result, MTO might wish to consider the feasibility of the selection of these tools for inclusion in GES based on weighing their predictive value against other practical considerations.
Implementation considerations. Based on the findings of the GES Review, MTO might wish to consider several recommendations to guide the implementation of the selected cognitive screening tool(s) within the current GES framework during the pilot phase of this project. These include:

- Update GES materials to reflect the inclusion of a cognitive screening tool including the DIC Manual and Renewal Application Form.
- Gain DIC support and buy-in for the inclusion of a cognitive screening tool by presenting the minimal increase in workload as a trade-off for increased referral authority to the road test (and possibly the Medical Reporting Program).
- Administer the tool immediately after the education session has ended or alternately, after the completion of the vision test.
- Create an instructional slide to add to the GES PowerPoint that includes animations of how to complete the tool to mitigate language and literacy barriers.
- Emphasize to seniors that the tool is one additional element of the licence renewal process that can help identify senior drivers who might be at heightened risk of collision and subsequently, protect them and the public.
- Score the tools while waiting for seniors to complete the knowledge test.
- Make a determination as to whether the failure of the cognitive screening tool alone automatically triggers a referral to the road test or if a combination of factors will be taken into consideration to make the referral decision.
- Consider the development of a referral matrix which would enable DICs to weigh different pieces of information to determine whether a road test is necessary for a particular senior driver.
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1. INTRODUCTION

1.1 Background: The issue of older drivers

The elderly population in Canada continues to increase. Seniors represent the fastest growing population group in Canada and this is also the case in Ontario. Based on population projections from Statistics Canada, Human Resources and Skills Development Canada (2012) reported that in 2011 there was an estimated 5 million Canadians over the age of 65. This number is expected to reach 10.4 million by 2036. Using today’s licensing rates in Canada, it is anticipated that in excess of 4.6 million Canadians aged 65 or older will hold valid driver licences after 2021. This number will further increase to 6 million by 2031 (Robertson and Vanlaar 2008).

Collisions, fatalities, and injuries. The increase in the number of senior drivers is a cause for concern given that this group of drivers account for the second largest proportion of road deaths. Only young drivers have a higher fatality rate. For example, in Canada in 2006, seniors aged 65 and older accounted for 16% of road deaths (462 fatalities). Moreover, there were 15,545 senior driver road injuries that year (Transport Canada 2007). Canadian seniors (aged 65+) have the second highest motor vehicle death rate among licenced drivers, with an average of 15.7 deaths per 100,000 licenced drivers compared to 9.6 deaths for drivers aged 45-54. In 2010, there were 508,593 Ontario licenced drivers aged 75 and older, 12,568 of which had collisions that year. This translates to 247 collisions per 10,000 elderly drivers (MTO 2010).

Impairments. Older drivers are at an increased risk of suffering from late-life cognitive impairment and dementia (Carr et al. 2006; Carr and Ott 2010; Dobbs 2005). These diseases are concerning as they can affect one’s ability to drive safely. Dementia, in particular, affects the brain and may impair the ability to think, react, remember, and speak. It also impairs a person’s logical reasoning, memory, and language skills. Dementia increases crash risk 2.5 times (Cooper et al. 1993). This is disconcerting as it is estimated that 13% of adults age 65 and older suffer from the disease (Alzheimer’s Association 2012). Between 1997 and 2005, 210,000 people in Ontario were diagnosed with dementia and approximately 40,000 of these individuals had a valid driver’s licence. Of these drivers, 9,000 were involved in a collision and one-third had taken psychotropic drugs (Rapoport et al. 2008). The number of drivers in Ontario with dementia is projected to reach 100,000 within the next 15 years.

Impairments may also come from diseases or conditions that affect drivers physically, for instance, visual impairments such as cataracts, glaucoma, or macular degeneration (Lampman 2002). A study evaluating the impairments of elderly drivers injured in crashes found that those who had crashed were four times more likely to have glaucoma when compared to the control group which consisted of elderly drivers who had not crashed (McGwin et al. 1997). Physical impairment may also result from conditions such as arthritis. This disease causes joints in the body to begin to degenerate which leads to redness, swelling, and pain. The pain and resulting loss of strength can cause drivers to become tired and distracted while driving and decreases the range of motion they have to properly survey the road (Lampman 2002).
Notable declines that come with aging can impair elderly drivers, making common driving much more challenging to complete. Older adults have a diminished capacity for processing information, especially in their periphery due to sight loss and diminished ability in contrast sensitivity, compared to younger drivers. Other weaknesses due to age are declines in short-term memory and speed of processing – skills which are needed to effectively survey the road and appropriately respond to hazards. For instance, age-related cognitive decline might lead to decreases in secondary looks (i.e., checking more than once for traffic or a free space for merging) and situational awareness (i.e., noticing pedestrians or other road users surrounding the driver), especially during turns (Romoser and Fisher 2009).

**Age-based and disease-based screening.** By and large, the identification and diagnosis of medical conditions that have the potential to affect driving performance has been left to healthcare professionals. Due to the increase in the number of licenced elderly drivers (a group which as a whole are more likely to suffer from a physical or cognitive impairment that may affect their driving), this may no longer be an option. Some jurisdictions have opted to implement age-based licence renewal processes in an effort to identify those drivers who present a heightened risk of collision based on various factors (e.g., performance on a vision test, performance on an on-road driving test, and so forth). Age-based screening requires all drivers of a certain age to complete certain requirements and/or testing in order to be eligible to renew their licences.

At present, there is still debate regarding whether age-based screening is effective and leads to increased road safety. Several studies show that age-based screening for fitness to drive does not produce any safety benefits (e.g., Grabowski et al. 2004). For instance, crash rates were compared across six Australian states, five with varying screening processes and one state without age-based screening. It was found that crash rates were the lowest for the state without age-based screening (Langford et al. 2004). A similar study conducted in Denmark by Siren and Meng (2012) found no increase in road safety after implementation of age-based screening and instead found a detrimental effect. When comparing crash rates before and after the implementation of mandatory age-based screening, no statistically significant difference in the number of older drivers involved in fatal crashes was found. There was however, a significant increase in the number of unprotected older road users who were killed between the two periods of observation. This could mean that the age-based screening caused older drivers to stop using their vehicles and instead use unprotected, less safe modes of transportation such as walking (Siren and Meng 2012). However, based on a different interpretation of their findings, one could also argue that the true cause of an increase in fatalities is the lack of safe, alternative transportation modes for seniors, rather than the screening process itself. This speaks to the importance of taking a holistic approach with respect to the elderly driver issue. Age-based screening alone cannot address all aspects of the issue. For example, viable transportation alternatives should be available for seniors who are deemed unfit to drive or for those who make a responsible decision to retire from driving.1

1 For elderly drivers who are not yet ready to retire from driving, another option is to promote prolonged driving through education and conditional licencing.
Finally, the issue of screening for dementia in the licence setting may not have been rigorously studied to date. However, it is possible that a system that identifies previously undiagnosed individuals with dementia could have health benefits and help improve road safety. The knowledge of the presence of a neurodegenerative disease could assist older drivers, family members, and physicians in making decisions related to driving competency. Nevertheless, decision analysis studies have not yet shown the benefits of systematically screening and evaluating demented drivers (Leproust et al. 2008; Retchin and Hillner 1994).

Research has also demonstrated that the crash risk of elderly drivers can be both overestimated and underestimated (Meng 2010; Langford et al. 2004). The presence of these biases further complicates the issue. For example, compensatory strategies are often not taken into account. Elderly drivers often choose not to drive during poor weather conditions, on unfamiliar roads, and may avoid dangerous maneuvers which might reduce overall crash risk (Fastenmeier 2013). Ultimately, to date, the research community has not yet reached a consensus as to whether age-based screening increases traffic safety or not. In the absence of such a consensus, and in light of the expected increase in the number of elderly drivers on Canada’s roadways, it is pressing to adopt some form of screening in combination with other measures, such as ensuring access to safe, alternative modes of transportation. This makes the need for an effective and efficient screening tool pressing.

In this regard, other studies have analyzed the validity of the elderly driver assessment process, some of which specifically explore the literature surrounding cognitive assessment tools. Mathias and Lucas (2009) conducted a meta-analysis of cognitive predictors of unsafe driving in older drivers. The authors emphasize that although the on-road driving assessment is considered the “gold-standard” for assessing driving competence, on-road is not always feasible on a large scale when considering both financial and time constraints. Instead, cognitive tests should be valued for the additional useful information they can provide, such as the identification or indication of the presence of cognitive deficits that cannot be ascertained from an on-road examination alone. It is within this context that the Meta-Analysis of Cognitive Screening Tools for Drivers Aged 80 and Older was conducted.

### 1.2 Elderly driver licence renewal and GES

Presently, the Ontario Ministry of Transportation (MTO) has a system in place to assess drivers with the goal of differentiating drivers who may be at greater risk of causing a crash from those who are not. Three driving programs have been developed to meet this end, two of which focus specifically on elderly drivers.

1. **Mandatory Medical Reporting Program** – requires that every person, 16 years of age or older, who suffers from any condition which could affect their driving is reported to the Ministry by their physician or optometrist. Police officers may do the same if they discover an unsafe driver through collision or other investigations.

2. **70 and Older Collision Program** – any driver aged 70 or older must pass a vision, knowledge and G2 test (level two road test in the graduated licence program of Ontario) in
order to maintain their licence if they are involved in a collision or convicted of a traffic offence related to a collision.

3. **80 and Above Licence Renewal Program** – consists of a two-year renewal cycle along with the combined use of both vision and knowledge tests, driver record review and a Group Education Session (GES) for all drivers aged 80 and over. If necessary, a road test is included if the driver appears to pose a risk to road safety. The GESs are delivered by MTO Driver Improvement Counsellors (DICs) at 200 approved locations across the province. Each session is approximately 90 minutes long and is designed to accommodate a maximum of 15 participants per session. The sessions educate the participants about important issues such as high-risk driving situations for their age group, physical challenges related to aging, and ways to reduce collision risk.

The 80 and Above Licence Renewal Program (or GES) consists of five elements that are used for screening elderly drivers which include:

- a review of demerit points on the driving record;
- a vision test;
- attendance and participation in GES;
- a written knowledge test on road rules/signs and traffic safety; and,
- an on-road test (only if deemed necessary).

A recommendation to take a road test is made for all senior drivers who have demerit points (two or more) or collisions on their record and may also be made for those who have obvious language barriers or clearly do not engage during the session. Elderly drivers who self-report a medical condition (physical or mental) may also be referred by DICs to the Medical Reporting Program. If a road test is required, the DIC refers the senior to a DriveTest Centre. Failure of the on-road test typically results in the expiry of driving privileges although seniors can attempt to pass the road test more than once.

The challenge that MTO currently faces is the lack of a reliable way to assess whether drivers suffer from cognitive impairments. Although the DICs may be able to identify obvious cognitive impairments, mild or discrete impairments are still detrimental to one’s ability to drive and are much more difficult to detect. In order to address this problem, it would be helpful to incorporate a screening element into the current GES framework which will accurately indicate the presence of cognitive impairments that compromise fitness to drive. This screening tool must be easily understood and applied by non-medical professionals who interact with senior drivers during GES. It must be inexpensive and easily administered to a group of 15 seniors and simple for drivers to complete.

**1.3 Objectives**

This project consists of four phases. In the first phase, the literature regarding cognitive screening tools for elderly drivers was reviewed and a meta-analysis was conducted. The second phase
consisted of a review of Ontario’s GES and an environmental scan of elderly driver programs internationally to identify best practices. The third phase is a synthesis of the Phase 1 and Phase 2 results. Based on this synthesis, the effectiveness of the selected cognitive screening tools is weighed against the implementation considerations and criteria identified through the GES review to identify which tools are most feasible to incorporate into GES and pilot test.

The primary objective of this current report is to summarize and synthesize the findings from the two previous phases of this project with the goal of making final recommendations with respect to the selection of several cognitive screening tools which will be piloted in Phase 4.

1.4 Structure of this Phase 3 report

In the introduction, the issue of older drivers is described, highlighting common afflictions that affect elderly individuals’ ability to drive safely as well as the debate regarding the use of age-based screening for licence renewal purposes. A brief overview of the senior driver programs available in Ontario with emphasis on GES is provided along with a description of the project and objectives of Phase 3.

The Methodology section describes the process that was undertaken in order to conduct the Phase 1 meta-analysis and the Phase 2 program review of GES, including the best practices review of elderly driver programs internationally. The Results section highlights the key findings from both the meta-analysis of cognitive screening tools and the GES program review. Consideration of the implications of the selection of tool(s) to pilot test is contained within the Discussion section.

Finally, a Recommendations section identifies the cognitive screening tools which are most feasible for inclusion within GES and an explanation of why the other tools in the Meta-Analysis are less desirable options. Implementation considerations that can guide the pilot testing of these tools are also discussed.
2. METHODS

2.1 Phase 1 methodology

The purpose of Phase 1 of this project was to conduct a meta-analysis of the various studies available that evaluate cognitive screening tools and their predictive value of safe driving. A meta-analysis combines results from different studies in order to identify patterns among study results and summarize these results into an overall effect size. In this meta-analysis, the effect size estimates how well cognitive tools, overall, can predict safe driving. Findings from this analysis are discussed in greater detail in the results section. The following flowchart describes each step involved in the selection of cognitive screening tools and their evaluation data for inclusion in the meta-analysis:

**Figure 1: Flowchart of meta-analysis**

- A literature review is conducted: 446 relevant articles are pulled.
- From these 446 articles, 68 are selected which evaluate a cognitive tool(s) in relation to driving ability.
- There are 142 data points (tool evaluations) which evaluate 42 tools. Some articles evaluate more than one tool and some tools have more than one data point.
- After MTO criteria are applied to the 142 data points, 27 data points remain.
- Data points with incomplete data are removed: 15 data points remain.
- The 15 remaining data points combined evaluate 10 different tools.
As can be seen in Figure 1, the meta-analysis began with a review of the literature. Three researchers independently identified articles relevant to the project using a variety of search engines and online catalogues, journals, proceedings, and other libraries. Terms such as assessment, attention, elderly drivers, fitness to drive, psychomotor, and neuropsychology were used to identify relevant articles. In total, 446 articles were identified for further analysis. The articles were sorted into three groups: ‘unusable’, meaning the articles did not provide information relevant to cognitive tools and elderly driving; ‘somewhat usable’, meaning the articles did provide information relevant to cognitive tools and elderly driving but did not contain actual tool evaluations usable for the meta-analysis; and then all articles which evaluated a cognitive tool or tools in relation to predicting the driving ability of the elderly. There were 142 tool evaluations identified after the researchers completed this review process. Those in the second category were used to support the write-up of the results, even though they were not included in the meta-analysis per se.

These tool evaluations were then coded for the development of the database. The main purpose of the meta-analysis is to recommend tools which will be applicable for use in the GES setting. As mentioned, the GES session is approximately three hours in length, has one DIC administering the session, and contains a maximum of 15 participants. The tools that will be considered for inclusion in GES need to be relatively quick to administer, easy to score, and completed in a group setting without strict individual supervision. In order to ensure that tools that are suited to this setting are included in the meta-analysis and non-applicable tools are excluded, the 142 study evaluations were coded with a predetermined set of criteria (referred to as ‘MTO criteria’ in Figure 1). The criteria were as follows:

- **Duration of test** – a variable was created to select tools of different duration; we selected those tools that can be administered in less than 30 minutes;
- **Administration of test** – a variable was created to select between tools that are not limited to individual (one-on-one) administration versus tools that can only be administered individually (e.g., they require the participant to recall words to the administrator or the test is timed); we selected those studies of tools that do not require individual administration;
- **Feasibility of administration** – a variable was created to distinguish between tools according to their ease of administration and scoring; we used it to select those studies of tools that are either easy to administer (i.e., simple instruction) or easy to score (i.e., minimal calculation needed to arrive at the score) while tools that were difficult to administer and difficult to score were not included;
- **Computer** – a variable was created to distinguish between tools that only require pencil-and-paper versus tools that require an expensive piece of hardware like a computer or simulator; only tools that do not require an expensive piece of hardware, but that can be administered with pencil-and-paper were included; and,
- **Expertise** – a variable was created to distinguish between tools that are easily administered without specialized training versus tools that do require such training; only tools that do not require specialized training were included.

Other variables such as age range, control group, and outcome measures were coded in order to narrow the results and ensure that only appropriate tools made it into the meta-analysis (e.g., only
evaluations of tools using senior drivers were included). After this process, 27 tool evaluations were selected which met the aforementioned criteria. These evaluations were further analyzed and an additional 12 were excluded due to lack of data needed for the meta-analysis (e.g., no information was provided regarding standard errors), bringing the final number of data points to 15. These 15 data points evaluated a total of ten different tools. These data were analyzed using a random-effects meta-analysis and meta-regression analysis.

2.2 Phase 2 methodology

The purpose of Phase 2 was to gather in-depth information regarding the current structure of the GES in order to provide an overview of its strengths and challenges and to determine the feasibility of the inclusion of a cognitive screening tool into the existing program framework. This includes the identification of potential implementation barriers as well as the identification of program modifications that need to be made to the current GES format, structure, and content to accommodate for the inclusion of a tool. The second component of Phase 2 consisted of a best practices review of elderly driver licence renewal processes/programs worldwide with a focus on the degree to which cognitive screening tools are incorporated into these programs. Most importantly, this phase provides practical recommendations and considerations for the implementation of a cognitive screening tool in GES.

The methodology for Phase 2 is comprised of several steps. First, all GES program material was critically reviewed to further understanding about GES and to identify strengths and challenges related to the operation and content of the program. These materials which included DIC guidelines, GES PowerPoint presentations, the Senior Driver Handbook, the written knowledge test, information describing the licence renewal process, and previous evaluations and technical reports concerning the GES was used to aid in the development of discussion guides for the key informant interviews and the focus group with MTO staff. Moreover, this review was necessary to identify feasible opportunities to make modifications to the delivery of GES to allow for the incorporation of a cognitive screening tool. A GES workflow chart was also produced.

Second, the delivery of six GES sessions in the Ottawa and Toronto regions representative of GES sessions across the province was observed (five English sessions and one French session). The focus of the observations was the delivery of the program by the DIC (e.g., strategies used to deliver the material and engage with seniors; uniformity in the delivery of the material across locations), the level and nature of senior driver involvement (e.g., what concerns do seniors raise; what questions do seniors ask), and the length of time it takes to administer various elements of the program (e.g., vision tests, GES, written examination, scoring of written examination). The observational data were compiled and reviewed in conjunction with the program materials to identify potential areas for program improvement and features relevant to the implementation of the cognitive tool in GES. Included in the observation of the GES was the administration of an exit survey to the seniors in attendance. This survey was designed to capture the attitudes and feelings of the GES attendants towards the GES and the potential implementation of a screening tool.

To further augment data collected from the observations and exit surveys, key informant interviews with field service managers (FSMs) were conducted to gain their perspective on the strengths and
challenges of the current program and to identify any potential barriers to the inclusion of a cognitive screening tool. More specifically, FSMs were asked about any issues or areas of sensitivity related to the implementation of a screening tool, the feasibility of implementation within the current GES framework, and any concerns related to the use of a screening tool in general. In addition to the interviews, a focus group was conducted via conference call with FSMs and Regional Managers across the province to explore the aforementioned issues.

Lastly, an environmental scan of elderly driver licence renewal programs internationally was conducted to inform a best practices review. To complete the environmental scan, an extensive internet search was conducted and researchers reached out to contacts and experts in the area of licencing in jurisdictions across the world including Canada, the United States, Western Europe, Australia, and New Zealand. The collected information was synthesized to identify common program structures and the frequency with which educational sessions and cognitive screening tools are incorporated into the re-licencing process for senior drivers. After the scan was completed, follow-up was conducted with identified contacts via email and phone to obtain more detailed information about program policies, procedures, practices, and effectiveness.

To bolster this review with expert opinion, TIRF reached out to its network of contacts in traffic safety and government organizations to obtain information about elderly driver programs in various jurisdictions. These experts were also asked to provide a summary about practices/processes in their jurisdiction and/or country and specific information about effective programs that have been established, particularly those elderly driver programs that have been evaluated for effectiveness. Some of the agencies contacted included the National Highway Traffic Safety Administration (NHTSA), the Canadian Council of Motor Transport Administrators (CCMTA), the American Association of Motor Vehicle Administrators (AAMVA), the European Transport Safety Council (ETSC), the Canadian Association of Road Safety Professionals (CARSP), the Institute for Road Safety Research (SWOV) in the Netherlands, Centre for Accident Research and Road Safety Queensland (CARRS-Q) and VicRoads in Australia, Institut français des sciences et technologies des transports, de l’aménagement et des réseaux (IFFSTAR) in France, the Federal Highway Research Institute (BASt) in Germany, and the New Zealand Ministry of Transportation among others.
3. RESULTS

3.1 Phase 1 results

3.1.1 Cognitive screening tools included in the Meta-Analysis

A final list of ten cognitive screening tools that met the specific criteria provided by MTO (see Section 2.1) was produced. The tools are as follows:

Rey-Osterrieth Complex Figure Test. The Rey-Osterrieth Complex Figure Test is a neuropsychological assessment designed to evaluate visual perception. Participants are presented with a standard complex figure containing a variety of visual elements, a blank piece of paper, and a pencil or pen. Participants are instructed to copy the figure. There is no time limit for them to copy the figure. The administrator collects the figures and scores them using an 18-point scoring system. There are 18 different aspects of the figure the administrator must score based on how well each aspect of the drawing is reproduced. A point is awarded if the participant has correctly drawn an element in the figure and a point is withheld if they have not. The scoring system for this test must be purchased (50 scoring booklets - $88; scoring template - $20; reference guide - $14).

Single Letter Cancellation Test. The Single Letter Cancellation Test evaluates the presence and severity of visual scanning deficits. The test consists of a regular-sized piece of paper with six lines of 52 letters. Participants are instructed to cross out the letter ‘H’ whenever it appears in the rows (the letter ‘H’ is presented 104 times). No time limit is given for the test; however, participants typically require less than five minutes to complete the task. The score is calculated by counting the number of omissions (i.e., ‘H’s that were not crossed out). Scoring may also include counting the number of letters crossed out that were not appropriate (i.e., not ‘H’). Therefore, a lower score corresponds to better performance on the test. Copies of this test are available online.

Double Letter Cancellation Test. The Double Letter Cancellation Test is different from the single letter cancellation test insofar as the former requires participants to cross out two letters instead of just one. The test assesses visual scanning abilities. Participants are presented with a regular sized sheet of paper containing six lines of 52 letters. They are then instructed to cross out the letters ‘C’ and ‘E’ whenever either one appears (‘C’ and ‘E’ are presented 105 times combined). No time limit is given for the test; however, participants typically require less than five minutes to complete the task. There are several ways to score the test. The easiest scoring method is to calculate the score by counting the number of omissions (i.e., ‘C’s and ‘E’s that are not crossed out). The second method is to count the number of letters crossed out that were not appropriate (i.e., not ‘C’ or ‘E’). Similarly to the Single Letter Cancellation Test, a lower score corresponds to better performance on the test. Copies of this test are available online.

Traffic Sign Recognition Test. The Traffic Sign Recognition Test is a multiple choice exam which measures participants’ memory by requiring them to recall the meaning of a number of traffic signs. Each question consists of an image of a sign and several possible meanings for the sign. For example, a picture of a stop sign is presented. Participants are able to choose from a number of
answers: “Yield,” “Construction Zone,” “Stop,” or “Sharp Turn.” The number of correct answers participants achieve corresponds with their score. Test administrators score the test using an answer key.

**Maze Task Test.** The Maze Task is a short, pencil-and-paper screening tool designed to test attention, visuoconstructional skills, planning, and foresight. Participants are presented with a maze and instructed to complete the maze as quickly as possible without running into dead ends or crossing the solid lines. In order to ensure that the task is clear, participants may be given the option to complete a demonstration maze first, which is not scored. The maze must be completed in less than 61 seconds. The administrator must score the submitted mazes by evaluating whether the maze was completed properly (i.e., the participant reached the exit without crossing any solid lines and this was done in under 61 seconds). An image of the Maze Task is available online but it is proprietary and must be purchased through the developer of the test for use.

**Charron Test.** The Charron Test is designed to evaluate visual attention processing. The test consists of a piece of paper containing 19 pairs of objects and 37 pairs of numbers. Participants are instructed to place a checkmark next to all the non-identical pairs, as quickly as possible. There is no time limit given to complete the task. Performance on the Charron Test is determined by the administrator who counts the total number of errors. An error is defined as a non-identical pair that is not checked, or an identical pair that is checked, meaning a lower score is preferable. Availability of this tool is not known.

**Wechsler Digit Symbol Substitution Test (DSST).** The Wechsler Digit Symbol Substitution Test is designed to measure working memory and psychomotor performance. Participants are presented with a list of numbers 1-9, with a unique symbol under each number. Organized into rows underneath are several dozen numbers overtop blank boxes. Participants are required to insert as many of the unique symbols associated with each of the numbers in the rows as possible within a 90-second timeframe. Participants are instructed to fill-in the boxes in the order that they appear, and not to skip ahead. When the time limit passes, the test administrator counts the number of correctly filled-in boxes and this number represents the score. High scores are associated with very mild or no cognitive impairment, while low scores indicate more severe cognitive impairment. Any boxes correctly filled in after two or more consecutive blank boxes are not counted in the score. Adaptations of DSST are available online and can be purchased for approximately $109 (this includes 25 test forms and a manual).

**Visual Form Discrimination Test.** The Visual Form Discrimination Test is a brief, multiple choice test designed to measure the ability to make fine visual distinctions. The test consists of two sample questions, and 16 test questions. Each question has the following format: a simple design (referred to as the ‘target’) is positioned above five answer options (referred to as ‘stimuli’). One of the four stimuli matches the target exactly, and this is the correct answer. The remaining three stimuli contain minor variations, including rotation of peripheral elements or distortions of a major shape. Participants must indicate, for each of the 16 test items, which stimulus corresponds to each target. The scoring is based on a points system, with a higher score indicating better performance on the test. Two points are awarded for a correct match, one point is awarded for an incorrect match involving an error of a peripheral shape, and no points are awarded for an incorrect match.
involving a major shape error. The highest possible total score is 32 points. This tool can be purchased online (book of drawings and 100 record forms - $108; 100 record forms - $56).

**Clock Drawing Test.** The Clock Drawing Test measures cognitive capacity and executive functioning. Particularly, the test investigates visuoconstructional skills, working memory, and planning. Participants are given a blank piece of paper with a large circle drawn on it. The administrator indicates the top of the page to the participants. They are then instructed to draw numbers on the circle to make it look like the face of a clock, and to draw the hands of the clock to read “ten after eleven.” Participants are given an unlimited amount of time to produce the clock. There are a number of valid scoring methods for the test. The score is determined by several factors including the order and spacing of the numbers, whether the numbers are inside the clock face or not, the presence of clock hands and accuracy of the time drawn, and the presence of any markings unrelated to the task of drawing the clock (e.g., words, names, extra circles, underlines, or pictures). Since the clock-drawing test has two overall challenges – drawing the clock and drawing the time – scoring tends to reflect the participant’s performance on both of these aspects individually. Scoring templates for this tool are available at no cost online.

**Eight Item Informant Interview.** The Eight Item Informant Interview is meant to detect the presence and severity of dementia. The interview consists of eight questions, presented to the person responding to the questions to complete him or herself. While it is preferable for an informant (e.g., family member or caregiver) as opposed to the participant to complete the questionnaire, the interview may be administered to the participant directly. The questionnaire is scored by adding up the number of questions answered in the affirmative. Hence, a higher score indicates a greater likelihood that the participant is cognitively impaired to some degree. A score of zero or one denotes normal cognition, while a score greater than two indicates the likely presence of impairment. This tool is available online.

The following table contains an overview of these tools with an indication of their codes for each of the inclusion criteria.
<table>
<thead>
<tr>
<th>Tool</th>
<th>Image</th>
<th>Duration</th>
<th>Skills Tested</th>
<th>Administration</th>
<th>Feasibility</th>
<th>Computer</th>
<th>Expertise</th>
<th>Scoring Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rey-Osterrith Complex Figure Test</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Around 10 minutes to administer; 5 minutes to score</td>
<td>Visual perception; long-term memory; visual capacities</td>
<td>Pencil-and-paper: Re-creating a drawing</td>
<td>Individual completion in a group</td>
<td>No computer required</td>
<td>No expertise required</td>
<td>Test is scored using a points key</td>
</tr>
<tr>
<td>Single Letter Cancellation Test (Error)</td>
<td><img src="image2.png" alt="Image" /></td>
<td>Under 5 minutes to administer; under 3 minutes to score</td>
<td>Visual scanning skills</td>
<td>Pencil-and-paper: Filling in letters</td>
<td>Individual completion in a group</td>
<td>No computer required</td>
<td>No expertise required</td>
<td>Test is scored by counting number of omissions</td>
</tr>
<tr>
<td>Double Letter Cancellation Test (Error)</td>
<td><img src="image3.png" alt="Image" /></td>
<td>Under 5 minutes to administer; under 3 minutes to score</td>
<td>Visual scanning skills</td>
<td>Pencil-and-paper: Filling in letters</td>
<td>Individual completion in a group</td>
<td>No computer required</td>
<td>No expertise required</td>
<td>Test is scored by counting number of omissions</td>
</tr>
<tr>
<td>Traffic Sign Recognition Test (TSRT)</td>
<td><img src="image4.png" alt="Image" /></td>
<td>Depends on # of questions; under 3 minutes to score</td>
<td>Memory; knowledge of the meaning of road signs</td>
<td>Pencil-and-paper: Multiple choice</td>
<td>Individual completion in a group</td>
<td>No computer required</td>
<td>No expertise required</td>
<td>Test is scored using an answer key</td>
</tr>
<tr>
<td>Maze Task (Snellgrove)</td>
<td><img src="image5.png" alt="Image" /></td>
<td>1 minute to administer; under 1 minute to score</td>
<td>Attention; visuo-construcational skills; planning, foresight</td>
<td>Pencil-and-paper: Completing a maze</td>
<td>Individual completion in a group</td>
<td>No computer required, one stop watch used to time entire class</td>
<td>No expertise required</td>
<td>Test is scored based on if completed and errors</td>
</tr>
<tr>
<td>Charron Test Error</td>
<td>No image available</td>
<td>Around 5 minutes to administer; under 3 minutes to score</td>
<td>Visual attention processing</td>
<td>Pencil-and-paper: Identification of non-matching pairs</td>
<td>Individual completion in a group</td>
<td>No computer required</td>
<td>No expertise required</td>
<td>Test is scored by counting the number of errors</td>
</tr>
<tr>
<td>Tool</td>
<td>Image</td>
<td>Duration</td>
<td>Skills Tested</td>
<td>Administration</td>
<td>Feasibility</td>
<td>Computer</td>
<td>Expertise</td>
<td>Scoring Method</td>
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<tr>
<td>Wechsler Digit Symbol Substitution Test</td>
<td>![Image]</td>
<td>Under 5 minutes to administer; under 3 minutes to score</td>
<td>Working memory; psychomotor performance</td>
<td>Pencil-and-paper Symbol matching</td>
<td>Individual completion in a group</td>
<td>No computer is required</td>
<td>No expertise required</td>
<td>Test is scored by counting the number of errors or blanks</td>
</tr>
<tr>
<td>Visual Form Discrimination Test</td>
<td>![Image]</td>
<td>30 seconds to 8 minutes to administer; under 2 minutes to score</td>
<td>Ability to make fine visual distinctions</td>
<td>Pencil-and-paper Multiple choice</td>
<td>Individual completion in a group</td>
<td>No computer is required</td>
<td>No expertise required</td>
<td>Test is scored using an answer key</td>
</tr>
<tr>
<td>Clock Drawing Test</td>
<td>![Image]</td>
<td>Under 2 minutes to administer; under 5 minutes to score</td>
<td>Executive functioning</td>
<td>Pencil-and-paper Drawing</td>
<td>Individual completion in a group</td>
<td>No computer is required</td>
<td>No expertise required</td>
<td>Test is scored using a points key</td>
</tr>
<tr>
<td>8 Item Informant Questionnaire</td>
<td>![Image]</td>
<td>No image available</td>
<td>Under 10 minutes to administer; under 3 minutes to score</td>
<td>Presence and severity of dementia</td>
<td>Pencil-and-paper Questionnaire</td>
<td>Individual completion in a group</td>
<td>No computer is required</td>
<td>Test scored using number of affirmative answers</td>
</tr>
</tbody>
</table>
3.1.2 Meta-Analysis results
The meta-analysis provided evidence suggesting that cognitive screening tools that meet MTO’s logistical requirements for GES (i.e., inclusion criteria were satisfied) can be used to predict driving performance. It was found that, on average, when cognitive screening tools predict a driver is unsafe, there is a 94% greater chance that this driver will exhibit unsafe driving behaviour, rather than safe driving behaviour (or, alternatively, if the cognitive screening tools predict that a driver is safe, on average, it is 94% more likely that this driver will exhibit safe driving behaviour, rather than unsafe driving behaviour). Note that unsafe driving behaviour refers to unsafe performance during a road test, a simulator driving test, or crashing as evidenced by state-reported crashes.2

Results from this meta-regression can be used to rank order cognitive screening tools using empirical Bayes estimates in an effort to identify better-performing tools. This exercise, however, revealed that the results from this meta-analysis alone cannot be used for this purpose. It is recommended that these results are used in combination with other information such as sensitivity, specificity, and area under the ROC3 curve. However, such information is not available for all the tools included in this meta-analysis. Partial information was available in six studies about seven tools (several studies evaluated more than one tool). Using this partial information, and depending on one’s preferences regarding concerns for the public (implying fewer false negative predictions of unsafe driving behaviour are preferable; or, a high sensitivity is preferable) versus the individual (implying fewer false positive predictions of unsafe driving behaviour are preferable; or, a high specificity is preferable), DSST or Clock Drawing can be considered as preferred cognitive screening tools.

Regardless of results based on the rank ordering of tools, one also has to consider the fact that other tools included in the meta-analysis may be preferred depending on practical considerations. While all tools included in this study were selected based on a rigorous assessment using MTO’s criteria for the use of such tools in a GES setting, it is clear that some of the included tools will fit better in a GES setting than others. This is investigated in more detail in Phase 2 of this project. As such, it has to be emphasized that all ten tools included in this meta-analysis passed the test using MTO criteria, and therefore, all ten of them could be considered for use in MTO’s GES setting. The trade-off when using tools with a lower rank-order is that, while they may fit better from a practical point of view, they may be less effective in predicting unsafe or safe driving behaviour.

3.2 Phase 2 results

3.2.1 GES program review results
Relevant information was collected from the review of program documentation, GES observations, key informant interviews, focus group, and exit surveys to evaluate the feasibility of the incorporation of a cognitive screening tool into the current GES framework. What follows are the

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2 The studies included in the meta-analysis that used crash data were American.
3 ROC analysis quantifies the accuracy of diagnostic tests or other evaluation modalities used to discriminate between two states or conditions.
major points pertinent to the inclusion of such a tool in GES contained within the qualitative analysis:

**Attendance.** The number of seniors processed through GES continues to increase as the Canadian population ages. For instance, in 2006, the number of seniors who attended GES was 86,000. This number increased to 98,000 in 2009 and 117,000 in 2012. Attendance numbers are expected to continue to climb in the future which has the potential to affect the number of courses offered or even course sizes or the number of DICs as more seniors must complete the licence renewal process. Currently, the GES supports 15 participants and this number ideally should not increase. It is already challenging for DICs to balance their time between participants, especially if the seniors are “high needs” or are not participating. This makes it difficult to effectively assess individual seniors.

**Locations.** Location selection involves careful review of the needs of GES participants. The building itself must be easily accessible, parking must be free, and adequate bathroom facilities are necessary. It is best that participants do not have to drive lengthy distances to attend and, ideally, the room in which the session is offered should be spacious enough so seniors are not crowded as this can affect the learning environment.

**Curriculum.** The GES curriculum is standardized across the province. Although the delivery style may vary among DICs, the core content remains the same for all sessions. During the review process, DICs, managers, and seniors all noted that the curriculum material needs to be updated to reflect changes in road safety and signs. This includes updates to the Senior Driver Handbook, PowerPoint presentation, DIC training manual, and knowledge test. The written exam is offered in 17 languages, but is written at a university level, making it potentially too difficult for some participants. If language or literacy issues are present, participants have the option to schedule an oral examination in place of the written knowledge test. Overall, the education component is considered the strongest portion of the GES. An update of the curriculum and course materials provides an opportunity to include more information about cognitive impairments.

**Driver Improvement Counsellors.** DICs have several responsibilities with respect to the delivery of GES. They are required to review each participant’s driving record prior to the session in order to verify eligibility and to note the presence of any collisions or demerit points on the record. During the session, DICs must administer the vision test to each participant individually, deliver the general education session, encourage participation from attendees, administer and score the written knowledge test, and complete the Renewal Application forms of each participant. DICs might also need to make a referral to an on-road driving test for seniors who either have collisions/demerit points on their record or who fail to actively participate in GES. In general, DICs feel they lack the necessary authority (i.e., formal accreditation and training) to make these referrals in instances where they suspect cognitive impairments are present (e.g., referrals based on observations during GES). Unless participants have obvious impairments (e.g., are clearly unable to follow the material or engage when directly prompted by the counsellor), DICs are hesitant to refer them to a driving
test because this decision could be challenged by the senior or their advocate. Road test referral rates are fairly low; only 2-5% of GES participants are referred.

The incorporation of a cognitive screening tool as part of GES would require additional training for DICs. Not only would training be required for existing DICs but it would also have to be incorporated into the training requirements for any new recruits as well. Areas in which DICs would require training include: the purpose and effectiveness of the tool; how to administer the tool (including what instructions to provide to seniors); how to score the tool; how to interpret the results; how to communicate results to seniors; what actions the outcome of the tool would trigger (e.g., what must DICs do in the event of a pass or a fail?); and, what are the common problems that can occur with the administration of the tool and how to address them.

The trade-off for the increased workload associated with the inclusion of a cognitive screening tool is that DICs would have a test that would allow them to bolster observations and provide justification for making a road test referral. DICs want to identify and screen out those senior drivers who are at a heightened risk of collision and the use of a cognitive screening tool would assist them in this regard.

**Workload and resources.** For the most part, the workload of Driver Improvement Counsellors is manageable. Daily administration of general education sessions has the potential to be draining so counsellors designate specific days to conduct demerit point interviews to create variety and break up the monotony of course delivery. However, to deliver GES in an effective and efficient manner, DICs need an adequate level of resources and support. The issue that is most often raised with managers relates to the age of the equipment, such as the vision screeners. Counsellors also express the need to update the curriculum content and GES PowerPoint presentation. Furthermore, there are legitimate concerns about the impending increase in clientele without a comparable increase in resources. The inclusion of a screening tool could compound the situation and stretch resource allocation further, particularly if there are licencing and copyright fees that must be paid to use the selected tool. Additionally, changes will be required to the DIC training manual as a section on screening tool administration and scoring along with associated tasks must be added. Paper copies of the tool will be needed for each participant which is another cost as is scoring or marking guides for DICs. Lastly, slides might be added to the end of the presentation to provide seniors with the guidelines and examples of how to complete the tool. In order for the tool to be properly implemented, funding for these resources is required and DICs will likely also require some level of support (whether it be a guide or contact person at least during initial implementation) should they have questions or concerns regarding the administration of the tool and interpretation of results. Resources and support may also be required by those who respond to challenges and challenges.

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4 DICs do have the ability to refer seniors to medical reporting as opposed to the road test if the senior self-reports a medical condition (including cognitive impairments).

5 It is not known what effect, if any, the inclusion of a cognitive screening tool will have on the road test referral rate. The suggested approach is to rely on a combination of factors to make referrals as opposed to the outcome of the cognitive screening tool alone. This issue is further discussed in Section 5.2.1 with the creation of a ‘referral matrix.’ The potential increase or decrease in the number of road test referrals should be taken into consideration during the pilot testing – this will be part of the next phase of this project, i.e., Phase 4.
complaints regarding tool outcomes (such as field services managers). These individuals might have to justify the selection of a particular cognitive tool and subsequently, would require knowledge about the instrument. Additionally, if the use of the cognitive screening results in more referrals to on-road testing, this will result in an additional burden on driver examiners who conduct the road tests as well as on clerical staff (e.g., scheduling appointments).

**Senior feedback.** Seniors were asked to complete an exit survey at the end of their GES session. The purpose of the survey was to elicit feedback regarding their experience participating in GES and more specifically, to identify which aspects of GES were beneficial, what can be done to improve the program, and what concerns they had, if any, about cognitive screening tools. In total, 64 seniors completed the survey out of a potential sample of approximately 90 GES attendees. The reasons for low completion rates included language and literacy barriers (many of the seniors who did not fill out the survey expressed willingness to do so but found it to be written at a level that was too challenging) and the perception that the survey was too long and would thus be time consuming to finish.

Of the 64 seniors who completed the survey, 96% agreed that GES should be a part of the licence renewal process and 100% found the sessions useful. The respondents valued having their road safety knowledge refreshed and found DICs to be both helpful and encouraging. With regard to the inclusion of a “simple screening tool,” of those seniors who responded to the question, 79% thought a screening tool would be useful. Few seniors (12%) expressed concern about the use of such a tool.

**Manager feedback.** Managers were asked to provide feedback regarding the feasibility of the integration of a cognitive screening tool into GES. They brought up important considerations for tool integration, mainly, the potential physical limitations of participants (e.g., arthritis making use of a pen difficult, anxiety, and tremors) and language barriers. They also pointed out the importance of using a tool which would require little training for the DICs and did not lengthen the session (i.e., does not take more than five minutes to administer and does not take in excess of two minutes to score each tool). Ideally, the tool would not require any subjective scoring in order to ensure uniformity across DICs; this also reduces the likelihood of referral challenges by seniors and/or their advocates. Many of these factors were taken into consideration in the meta-analysis portion of tool selection. In general, managers did not see the addition of a cognitive screening tool as a major issue, except for potential push back from DICs who already feel the time constraints of the current session. Managers were in consensus that the majority of DICs would likely be receptive to the inclusion of a cognitive screening tool as it would provide them with increased referral authority.

### 3.2.2 Best practices review results

An environmental scan and outreach to experts and program administrators resulted in the identification of approximately 40 elderly driver programs and licence renewal processes internationally. Most jurisdictions do not include mandatory age-based screening for the purpose of licence renewal. Instead, programs or processes can be classified in one of the following three categories:
1. **Voluntary education courses and/or testing.** Voluntary educational programs and refresher courses are popular options internationally. These programs are tailored to a mature driver audience (age 55 and older) and focus on the improvement of driving habits, traffic safety and rules, how to compensate for the effects of aging, the effects of drugs on driving performance, and so forth. In some jurisdictions, an on-road driving assessment could be included as part of the program to make elderly drivers aware of their strengths and weaknesses and to provide feedback on how to drive in a safer fashion. Examples of these programs, which are typically administered for free or a nominal fee, include the AARP Driver Safety Program (United States), mature driver workshops (Canada), county-level programs such as the Drive Safely for Longer Course (Great Britain), Mobility Matters(Ireland), BROEM (the Netherlands), and Moving Right Along (South Australia).

2. **Medical examination or assessment required if ‘cause for concern.’** A majority of jurisdictions only assess elderly drivers who receive a clinical diagnosis of diminished physical or cognitive functioning which affects their ability to drive safely. These impairments are identified by primary physicians or other healthcare providers, who have a legal obligation or duty to notify the appropriate licencing authority (e.g., Department of Motor Vehicles) which then makes an ultimate determination regarding licence status. Drivers may also be brought to the attention of the licencing authority through self-reporting of conditions or by concerned third parties. In these jurisdictions, the focus is on fitness to drive in general as opposed to age-specific screening and assessment. Drivers with suspected or confirmed physical or cognitive impairments may be required to undergo medical assessments or successfully pass an on-road drive test. Jurisdictions such as Nova Scotia, Maryland (Functional Capacity Screening), and Victoria (Occupational Therapy Driver Assessment) all have rigorous assessments for drivers identified through the medical reporting process.

3. **Mandatory examination and/or mandatory medical assessment.** Jurisdictions with mandatory physical and cognitive screening processes for all elderly drivers are much less prevalent, and in some instances, have programs in the infancy stage of development or pilot implementation (such as in California and the Netherlands). This type of program requires all drivers who are of a certain age to complete some form of medical assessment or other licence renewal requirements. The age at which screening becomes mandatory varies although it is most commonly between the ages of 70 and 80. Elderly drivers are required to submit proof of their fitness to drive in the form of medical reports to the licencing authority on a frequent basis (generally every one to five years depending on the jurisdiction). Written knowledge examinations and on-road drive tests might also be a requirement of licence renewal for all mature drivers or for those who medical reports identify as at heightened risk of collision.

The following tables contain an overview of the available elderly driver programs and licence renewal processes in various jurisdictions (e.g., Canada, the United States, Europe, and Australasia).
| Voluntary educational courses | Manitoba - Manitoba Public Insurance (MPI) in partnership with Safety Services Manitoba offers a workshop that educates older drivers on traffic laws and road safety rules and provides practical advice on safe driving and how to compensate for the physical effects of aging. Attendance of the *Mature Driver Workshop* is free (i.e., there is no fee).  
**Saskatchewan and Prince Edward Island** - The *55 Alive/Mature Driver Refresher Course* is open to any driver age 55 and older in Prince Edward Island and Saskatchewan at no cost. The goal of the course is to help older Canadians maintain their independence through the improvement of their driving skills. |
|-----------------------------|---------------------------------------------------------------------------------------------------|
| Medical examination or assessment required if 'cause for concern' | Manitoba - if a driver, physician, or a third party submits notification about impaired driving ability on account of a medical condition, the driver in question is subject to licence suspension and is informed that they are to see a physician for further testing to determine the severity of impairment. MPI’s Medical Compliance and Assessment Department reviews each file and determines whether drivers are eligible for licence reinstatement or restoration of driving privileges.  
**Nova Scotia** - drivers of any age are referred by their physicians for assessment at Capital Health if there is a clinical diagnosis of a physical or cognitive impairment. This facility is equipped to test for a variety of impairments that result from diseases such as dementia or Parkinson’s. If the impairment is psychological or cognitive in nature, tests such as the MMSE, MoCA, Trailmaking A and B, MVPT, road sign test, bells scanning, and UFOV may be used. A road test might also be required to assess the degree to which the impairment affects driving ability. The outcomes of the screening and road test are sent to the Registry of Motor Vehicles (RMV) and a determination is made to suspend the driver’s licence, restrict driving privileges, or renew the licence.  
**Saskatchewan** - the Medical Review Unit (MRU) of Saskatchewan Government Insurance (SGI) reviews the cases of all drivers with medical conditions. Medical practitioners, such as physicians, nurse practitioners, ophthalmologists, and optometrists are required to report medically unsafe drivers to the MRU. All drivers also have an obligation to self-report any impairment. Final determinations regarding driving privileges and status are made based on functional ability, not age.  
**Yukon** - drivers are subject to mandatory assessment if there is suspicion or diagnosis of cognitive impairment reported to the licencing authority. In most cases, the Motor Vehicles Department (MVD) will refer drivers to a DriveABLE facility for further testing. DriveABLE includes an in-office Cognitive Driving Assessment (DCAT) which is administered via computer. The test takes approximately 30 to 60 minutes to complete and is overseen by healthcare professionals and certified evaluators that have specialized training. The test itself measures memory, attention, reaction time, and judgment through touch screen and push button responses. MVD reviews the results of the testing and takes licencing action if necessary. |
| Mandatory examination and/or mandatory medical assessment | Alberta - Alberta Transportation mandates that all drivers age 75 and over demonstrate fitness to drive in order to retain their licence. Once Alberta drivers reach 75 years of age, they must provide a certified medical examination from their primary physician to the Driver Licencing Division. This examination is to verify that the senior has no physical or cognitive impairments that could hinder driving ability. After the age of 80, seniors must provide a medical examination to the bureau every two years in order to be eligible for licence renewal. Alberta does not have any provisions for mandatory road tests of elderly drivers. If the medical |
examination indicates that mental or physical impairments are present, seniors are then required to complete further testing (which may include a road test) before being eligible for licence renewal.

**British Columbia** - the Office of the Superintendent of Motor Vehicles (OSMV) requires that all drivers age 80 and older submit to a medical examination that their personal physician conducts. This medical examination is a mandatory condition of licence renewal and is required every two years after the age of 80. If impairment is found, it is reported to OSMV and a case-by-case determination is made regarding the limitation or cessation of driving privileges. As part of the determination process, individuals might be required to submit to further medical examination or undergo a functional assessment. Drivers who exhibit signs of cognitive impairment must take the *DriveABLE* test. The assessment measures memory, attention span, spatial judgment, reaction time, and decision-making. Those who fail the test receive a high-risk classification and must then complete an on-road drive test. The assessment results are submitted to OSMV and a determination is made about driving status.

**Northwest Territories** - NWT Transportation requires all holders of a NWT Class 1, 2, 3, or 4 drivers’ licence to submit a *Driver’s Medical Examination Report*. This includes annually after age 65. Those individuals who hold Class 5, 6, or 7 driver licences are required to submit the report once at age 75 and age 80 and then every two years. NWT Transportation has the authority to request that drivers submit medical reports on a more frequent basis than the guidelines suggest. The submission of medical reports is also a requirement in instances where a person (of any age) has an identified medical condition or impairment that may limit driving ability. In order for the report to be valid and acceptable to the Registrar of Motor Vehicles (RMV), it must be completed by a NWT medical practitioner. The results of the medical report may require drivers to complete a written knowledge or practical road test.

### Table 3: Summary of elderly driver programs and licence renewal processes in the United States

<table>
<thead>
<tr>
<th>Voluntary educational courses</th>
<th>Massachusetts - the <em>Elder Outreach Program</em> is a voluntary program offered by the Registry of Motor Vehicles (RMV) and is educational in nature with a focus on the improvement of driving habits for mature drivers.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Minnesota</strong> – the <em>St. Cloud State University Driver Improvement Program</em> has content comparable to the 55 Alive courses offered in Canada. This program is also a Minnesota Department of Public Safety approved accident prevention course and costs $20-24 to attend.</td>
</tr>
<tr>
<td></td>
<td><strong>Pennsylvania</strong> – the Pennsylvania Department of Transportation approves a variety of programs tailored specifically for senior drivers. These programs are classified as <em>Basic and Refresher Mature Driver Improvement</em> courses and address specific safety needs of older drivers by helping them understand how aging affects their driving abilities. These programs do not include a written or on-road driving test and the fees vary depending on the agency that oversees delivery.</td>
</tr>
<tr>
<td></td>
<td><strong>Washington</strong> – the Department of Licencing approves a collision prevention course for senior drivers. The program is voluntary and can be delivered in a variety of formats including a conventional classroom setting, online, or through videos.</td>
</tr>
<tr>
<td></td>
<td><strong>American Association of Retired Persons (AARP)</strong> – the AARP offers a <em>Driver Safety Program</em> that is available across the country. The program is geared toward individuals age 50 and over.</td>
</tr>
</tbody>
</table>
with a focus on current rules of the road, defensive driving techniques, safe vehicle operation, and how to manage and accommodate age-related changes in vision, hearing, and reaction time. The delivery of this course can be in either a classroom or online setting for nominal fees ($12-14 for the classroom course and $16-20 for the online course).

**American Automobile Association (AAA)** - the **AAA Mature Operators** course is an online or in-person driver improvement program that provides tips and techniques to help experienced drivers compensate for changing vision, reflexes, and response time. It provides a quick refresher on defensive driving skills, new traffic laws, road markings, and traffic signs. It also shows how many older driving methods have been replaced by more advanced, risk-reducing driving techniques. A variety of other resources for senior drivers including self-rating tools to assess driving habits and ability (**Drivers 65 Plus**), an interactive driving evaluation, and information about in-car driving evaluations and clinical assessments are also available online.

| Medical examination or assessment required if ‘cause for concern’ | **Colorado** - the DMV does not have an elderly driver-specific assessment process but it does have an at-risk driver identification and remediation program. This program applies to drivers of all ages and action is triggered by the submission of incident reports from law enforcement, family members, courts, prosecutors, and/or doctors. Dependent upon which indicators or symptoms are present, drivers must obtain medical clearance and pass a knowledge and skills test in order to apply for licence remediation. The cognitive screening or assessment tools that are relied upon are not chosen by the DMV; health professionals who examine the drivers are responsible for tool selection. |
| **Connecticut** - drivers may be required to undergo an in-person driving evaluation at the offices of Connecticut Neuropsych if there is concern that impairment exists. The performance of test subjects is compared to the performance of ‘safe drivers’ in their age group to determine whether driving privilege restriction is necessary. |
| **Maryland** - the Motor Vehicle Administration (MVA) manages **Tiered Driver Functional Assessment** and **Functional Capacity Screening (FCT)**. The FCT is administered to those drivers who come to the attention of MVA’s Driver Wellness and Safety Division as a result of concerns regarding their level of cognitive functioning. Drivers receive a referral for screening by their physician or other treatment providers such as nurses, physician assistants, psychologists, law enforcement, or they may volunteer. The current FCT consists of a battery of tests that assess visual, cognitive, and physical abilities required for the safe operation of vehicles. These tests include the Motor-Free Visual Perception Test (Visual Closure subtest), Delayed Recall, a Scan Chart test to detect visual neglect, the Trailmaking B, and a PC-based variant of the Trailmaking B procedure that uses a dynamic traffic scene instead of a blank background. Overall, the FCT takes approximately 15-20 minutes to administer. Based on FCT performance, individuals’ cases are referred to the MVA’s Medical Advisory Board (MAB) which reviews driver medical information, driving record and crash history, and the FCT results. Once the review is complete, the MAB provides MVA with driving privilege recommendations. |
| **New York** - re-evaluation of driver skills and abilities is a requirement of the New York State (NYS) DMV. The NYS DMV has the authority to require an evaluation of drivers, regardless of age, whose driving abilities are called into question. The DMV Testing and Investigation Office examines reliably reported information (either by medical professionals, third parties, law enforcement, or individual drivers) to determine whether grounds for re-evaluation exist. If testing is required, drivers receive a certified letter that requests they report to the DMV for an in-person interview; failure to report results in the suspension of driving privileges. Drivers who are required to report to the DMV must complete an eye examination and also provide documentation such as a medical report completed by their primary physician. If the medical... |
examination indicates that impairment is present and limits driving functionality, further testing - including the completion of a written knowledge test and on-road driving skills test - is then required.

**North Carolina** - the *Driver Medical Evaluation Program* gathers and evaluates medical information of licenced drivers or applicants for driver licences who suffer from disabilities and/or conditions that could impact driving performance. Medical staff reviews medical records and statements from physicians in conjunction with driving history. An analysis of this information leads to the formulation of a recommendation as to what, if any, restrictions should be placed on licences.

**Oregon** - the DMV *Medically At-risk Program* focuses on individuals who are brought to the attention of the DMV on account of dangerous or unsafe driving behaviours or medical conditions that affect overall driving performance. The DMV requires these at-risk drivers to complete and pass various tests which can include a vision test, a written knowledge examination, and an on-road driving test. They may also be required to submit a record of medical history or obtain medical clearance to retain driving privileges. Licence renewal in Oregon is required every eight years, regardless of age, but starting at age 50, drivers must undergo vision screening with every renewal.

**Virginia** - the *Eastern Virginia Medical School Older Driver Evaluation Program* utilizes driving simulators to assess the driving performance of elderly individuals who are thought to suffer from cognitive impairments. Unlike many of the other programs mentioned, this one is age-specific. Upon completion of the simulation and following a review of driving history and medical information, a driving competence classification is applied. Driving evaluators can classify an elderly driver as safe, conditionally safe (i.e., in need of restricted driving privileges), or unsafe. Based on the recommendations made by driving evaluators, the Virginia DMV restricts licences when appropriate.

| **Mandatory examination and/or mandatory medical assessment** | **California** - one of the most robust and extensive driver assessment programs implemented is the *California 3-Tier Pilot Driver Assessment Program*. The purpose of the tiered system is to utilize screening and assessment to identify drivers (of any age) who require further assessment of driving ability or who might benefit from education about strategies to compensate for certain functional limitations. The assessment is required at the time of licence renewal. As currently conceived, the program is comprised of three levels or tiers of assessment. These tiers consist of:

- Tier 1 involves screening tests of visual, cognitive, and physical function.
- Those drivers who fail Tier 1 are required to take a computer-based test that gauges perceptual response time. All drivers, regardless of performance in Tier 1, are required to complete the knowledge test that is part of Tier 2.
- Tier 2 involves completion of the DMV’s 18-question written knowledge test for renewal of a Class C licence, and a computer-based test of visual function, the Perceptual Response Test (PRT).
- Tier 3 of the assessment is reserved for drivers who perform poorly in the previous two tiers or who have severe impairments. It consists of an on-road drive test and an educational intervention.

Due to inconsistent evaluation findings, the pilot program has yet to be implemented statewide and there is no indication whether the California DMV will pursue expanded implementation of... |
the program in the future.

**Massachusetts** - all drivers age 75 and older must pass a vision screening test at the time of licence renewal. In conjunction with this requirement is discretionary assessment based on notification of a medical or cognitive impairment made by either a healthcare provider or law enforcement official (this falls under the previous classification of assessment discussed in the preceding section). The RMV may request that drivers complete a *Competency Road Exam* in order to maintain their licence.

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**Table 4: Summary of elderly driver programs and licence renewal processes in Europe**

| Voluntary educational courses | Austria - the Austrian Road Safety Board (KFV) is currently in the process of developing a framework for group workshops targeted at drivers age 65 and older. The workshops range in size from 6 to 12 participants and are four hours in duration. The content of these workshops will focus on self-assessment and self-perception, support of perception, assessment, and decision-making skills, development and strengthening of compensation strategies, learning to assess risky driving situations, and use and strengthening of resources.  
Finland - the *Elderly Drivers Fitness Course* is for drivers age 65 and older and focuses on issues of road safety. A 27-question self-assessment questionnaire that gauges driving ability is included as part of the course.  
Great Britain – there are many educational programs carried out at a county or local level in Britain. For example, in Cumbria Road Safety Partnership offers the *Drive Safely for Longer Course* which provides those aged 65 and older with an opportunity to refresh their driving skills and knowledge through two informal drives accompanied by a local driving instructor. Participation in this course is at no cost.  
Ireland - a new program for elderly drivers was recently piloted and is soon to be officially released. *Mobility Matters* is an awareness program on road safety for older people. Instructors deliver the program in a group setting over a two-hour period; the session is meant to be highly interactive and activity-based. Educational materials in the form of a resource package and instructional DVD are meant to complement the session. Areas of focus are broad and include legal obligations, vehicle maintenance, safe driving practices, awareness, bus safety, pedestrian safety, cyclist safety, safety belts and child restraints, the effect that medical conditions and medications can have on driving performance, fatigued driving, planning for change and staying mobile, and alternatives to driving. Upon successful completion of the program, attendees are given a certificate that acknowledges their participation.  
Norway - all drivers that hold a class B licence are invited to participate in the *Driving 65+ Course* the year they turn 70. The course consists of both classroom discussion (up to 16 participants at a time) and practical driving sessions in groups of three. There is no formal curriculum but instructors do have a teacher’s guide that contains pertinent information and training strategies. In the practical portion, participants can choose to either drive themselves or let the instructor (a licenced driving instructor) demonstrate safe driving practices. Participation in the course is completely optional and attendees are charged a fee of approximately NOK 1000 (the equivalent of $180 CAD).  
The Netherlands - the ANBO (International Federation of Ageing) offers the *Be Mobile and Stay Mobile in a Safe Way Program* (BROEM) in the Netherlands. The Dutch BROEM is a voluntary assessment drive for individuals over 50 years of age; it is not a driving test. The
BROEM course includes an assessment of driving style, a vision test, a test of response time, and a refresher course on traffic rules. After the assessment drive, participants are given a report from an accredited driving instructor or examiner of the Dutch Driving Test Organisation (CBR) which indicates their strengths and weaknesses and also provides helpful suggestions for improvement of driving performance. The course is supplemented by a reference book which includes information on the effects of aging on driving and tips for older drivers to use to safely navigate roadways. To standardize the delivery of BROEM there is an instruction guide that details how to organize and administer the course.

| Medical examination or assessment required if ‘cause for concern’ | Great Britain - in the British counties of Devon and Cornwall, the **Roadfit** program is to be completed by drivers who receive a physician referral. The program consists primarily of an on-road driving assessment. Roadfit driving instructors do not have the authority to suspend driving privileges or licences but they can deem someone unfit to drive. Instructors submit reports on driver fitness to primary physicians after the assessment process is complete. These reports also contain a discussion of driving behaviours and strategies to improve safety.  
Sweden - the Swedish Transport Agency also relies on medical referrals to identify drivers with potential impairments. Fitness to drive is treated primarily as a medical problem and subsequently, age-based screening is not used even though theoretically, elderly drivers are more likely to suffer from conditions that could compromise driving ability. In Sweden, physicians are required by law to report to the licensing authority if any of their patients have illnesses or weaknesses that could jeopardize road safety. The licensing authority investigates and makes a determination on a case-by-case basis as to whether driving privileges are withdrawn. In-depth examinations performed by physicians are thought to be a much better way to identify cognitive functioning issues than the use of simple cognitive screening tools. |

| Mandatory examination and/or mandatory medical assessment | Denmark - a licence is valid until the age of 70 at which point renewal is required at four and two year intervals (70, 74, 76, 78, and 80). After age 80, drivers must renew their licence on an annual basis. Licence renewal involves a medical check performed by a physician, which includes a condensed version of the MMSE and the Clock Drawing Test in an effort to identify those drivers who have cognitive impairments.  
Ireland - all drivers age 70 and over must supply a medical report to certify that they are fit to drive when they apply for or seek to renew their licence. A licence can only be issued for either a ten or three year period at which point another medical report is required. There are mixed opinions on the effectiveness of this practice in Ireland. The National Programme Office for Traffic Medicine (NPOTM) has formally recommended that this practice cease and is due to consider optimal arrangements for the licencing/re-licencing of elderly drivers.  
Norway - all drivers age 75 and over are required to submit an approved medical certificate in order to maintain their licence and driving privileges. If a senior driver is involved in an incident/accident, the police may require that they submit to a driving test.  
The Netherlands - all drivers age 70 and over submit to a medical examination every five years in order to renew their licence. For those drivers with documented medical conditions that are included in the *National Regulations on Fitness to Drive* (e.g., epilepsy, diabetes), the period that a licence is valid is shorter. One unique element of the renewal process noted by the SWOV Institute for Road Safety Research is the requirement that elderly drivers in the Netherlands submit a ‘Personal Declaration’ about the status of their health. The declaration consists of a questionnaire that asks seniors to self-report conditions. Physicians complete a medical report, and identify any concerns related to blood pressure, visual acuity with and without correction (glasses), the field of vision, hearing, limitations in the use of... |
the neck, back, and limbs, and the general physical and mental condition of the applicant. Both the personal declaration and medical report are sent to the Dutch Driving Test Organisation (CBR) who decides whether the senior is fit to drive. In some instances, additional information is needed before a decision can be made. If so, seniors are obligated to see a specialist or perform a road test. If no impediments are found in the medical examination, the applicant receives a ‘Declaration of Fitness to Drive’ that is valid for five years. If there are doubts about future fitness, a limited validity of one to three years is given. In addition, limitations to the conditions under which a motor vehicle may be driven can be imposed by CBR and are noted on the licence and driving record.

With respect to cognitive functioning, there are currently no screening or assessment tools used in the Netherlands. However, a research project to develop and validate a neuropsychological test battery for the study of the fitness to drive of elderly people with cognitive impairments, especially people with mild dementia has recently started.

### Table 5: Summary of elderly driver programs and licence renewal processes in Australasia

| Voluntary educational courses | South Australia - *Moving Right Along* is a program that provides support and information to older people as they consider retiring from driving. A course kit (which consists of eleven factsheets, two guide documents, and PowerPoint presentations) serves as a community resource that is designed to allow anyone to become an instructor and deliver the program to a community group or organization. The kits are available in all public libraries in the state. Experienced facilitators are also available to deliver the workshop to community groups upon request (available free of charge).

| Medical examination or assessment required if ‘cause for concern’ | Victoria - VicRoads, in the Australian State of Victoria, requires assessments of drivers who are referred by physicians, gerontologists, optometrists, ophthalmologists, or occupational therapists due to the exhibition of signs of physical and/or cognitive impairment. The assessment includes a medical review, an on-road driving test, and an occupational therapy driving assessment. The Medical Review Driving Test takes between 15 and 45 minutes to complete. Drivers who fail are subject to licence suspension until they are able to take the test and successfully pass. Occupational therapists interview drivers and inquire about lifestyle, medical history, and driving records. Other areas of assessment include physical, visual, sensory, and thinking abilities (e.g., planning and concentration) and knowledge of traffic safety, road signs, and laws. If the *Occupational Therapy Driver Assessment* is favourable, drivers maintain their driving privileges. If a determination is made that driving privileges should be restricted, VicRoads may impose specific conditions on the licence or the licence could potentially be suspended.

| Mandatory examination and/or mandatory medical assessment | New South Wales - the State of NSW requires annual mandatory assessment beginning at age 75. Drivers receive a medical form that is to be completed by their doctor eight weeks prior to licence expiry. After age 85, in addition to the annual medical assessment, drivers are required to either undergo an on-road driving assessment every two years to maintain an unrestricted licence or can elect to have a modified licence instead (this licence restricts driving to local areas based on personal driving needs).

|           | Western Australia - the Department of Transport requires drivers who are over 80 years of age...
to satisfy the Director General that they are medically fit to drive prior to being eligible for licence renewal. In order to satisfy the Road Traffic (Authorization to Drive) Regulations, these drivers must complete an annual medical assessment form which is sent in the mail 12 weeks prior to the expiry of their licence. The assessment could require referrals for additional examination by a specialist or occupational therapist and/or a demonstration of driving ability through the completion of a road test. The medical assessment component is conducted by the driver’s doctor and includes visual and auditory testing in accordance with the National Guidelines Assessing Fitness to Drive. If an assessment by an occupational therapist is recommended the cognitive skills, range of motion, strength, coordination, and reaction skills of drivers are tested. A drive test might be necessary to complete this assessment.

Cognitive screening tools. The use of cognitive screening tools in a consistent fashion is rare with elderly driver licence renewal programs. While healthcare providers or occupational therapists may assess the cognitive functioning of some elderly drivers, few jurisdictions require the use of specific tools and fewer still require that all drivers undergo mandatory cognitive screening. Only a handful of the agencies and experts contacted were able to provide examples of cognitive screening tools that are used to assess elderly drivers. These included:

- Nova Scotia – MMSE, Trail Making A and B, MVPT, UFOV, MoCA, and bells scanning (tests may be used during assessment for drivers of any age that are referred by physicians).
- Maryland – MVPT, Delayed Recall, Trail Making B, a computer-variant of Trail Making B, and more recently, the Maze Test (test battery is mandatory for drivers of any age referred for screening by a physician, treatment provider, or law enforcement).
- Denmark – MMSE and Clock Drawing Test (condensed versions of these tests are mandatory as part of a medical check required for annual licence renewal for all drivers age 80 and over).
- Netherlands (SWOV study battery) - Reaction Test (Schuhfried’s RT), Determination Test (Schuhfried’s DT), Adaptive Tachistoscopic Traffic Perception Test (Schuhfried’s ATAVT), Trail Making A and B, Maze Test, Construction drawings, test for contrast sensitivity (vision), Snellen Test for visual acuity, and the Hazard Perception Test (for more information on the SWOV study and test battery, please refer to Section 4.1.3 in the Review of GES).

If MTO proceeds with the inclusion of a cognitive screening tool, this will further add to the unique and innovative nature of GES, albeit the impact will need to be studied prospectively and can also be evaluated regularly after the inclusion of a cognitive screening tool(s). In comparison to international programs, Ontario’s licence renewal process for elderly drivers is unique, progressive, and comprehensive. There are very few programs which include an interactive education session which encourages participation and learning. Due to the fact that cognitive and physical impairments are more likely to be present in an older population, having the cut-off age for licence renewal set at 80 makes it less prone to potential political and public objections that are typically associated with age-based screening.
**Best practice considerations.** Overall, there are several best practice considerations that emerged as a result of this review. These include:

- Quantify the magnitude of the elderly driver crash problem to inform decisions⁶;
- Use research to inform both education and policy;
- Evaluate existing programs and processes on an on-going basis;
- Implement in-person licence renewal for all drivers over a specified age;
- Ensure that medical review policies closely align with fitness to drive standards used internationally;
- Make medical referral information and requisite referral forms readily available and accessible to practitioners;
- Healthcare professionals should be properly trained to make referrals;
- Provide healthcare professionals with information about how to counsel at-risk drivers and when to report drivers who do not heed advice to stop driving;
- Establish a Medical Advisory Boards (MAB) to provide policy support to licencing agencies;
- Communicate with seniors about the effects of aging on driving performance and about alternative transportation options and community resources; and,
- Allocate resources strategically.

### 3.2.3 Phase 2 recommendations for GES enhancement

The information obtained from the program review and observation, interviews and the focus group with MTO managers, survey of senior participants, and environmental scan of international licence renewal programs/processes identified many strengths of the structure, delivery, and administration of the GES program. This process also provided insight into areas where some improvements can be made and how the program can be enhanced to better address the needs of its senior clientele and road safety in Ontario. The recommendations for program enhancement include:

1. Update the GES curriculum.
2. Make more resources available to seniors.
3. Include a driving habits questionnaire for seniors to complete.
4. Include a ‘Personal Declaration’ of health for seniors to complete to identify any health conditions.
5. Consider the elimination of the DIC administered vision test (i.e., require vision test prior to GES attendance).
6. Consider reduction of the maximum number of participants per GES.
7. Consider the benefits of the knowledge test.
8. Consider testing physical ability.
9. Continue to use a tiered approach (e.g., only high-risk drivers are referred to the road test).
10. Keep the GES required entry age at 80.
11. Evaluate GES by surveying senior participants and DICs.

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⁶ This consideration is important because there is no reliable estimate of risk for sub-populations if there is no reliable epidemiological set of data.
12. Provide more professional development opportunities and resources for DICs.
13. Emphasize the importance of identification of language/literacy barriers by Scheduling Clerks at the point of registration.
14. Expand outreach to inform medical professionals about their duty to report driver fitness.
15. Identify and implement best practices/innovative strategies.

These recommendations are in addition to the suggested inclusion of a cognitive screening tool which is the focus of this project.
When comparing the results from the meta-analysis with the findings from the review of GES, it is obvious that the process of tool selection is not straightforward. This selection must be done with both the predictive value of the tool and practical considerations of implementation in mind. Several of these considerations were accounted for when the cognitive screening tools were coded in the initial stages of the meta-analysis, notably duration, feasibility, expertise, equipment, and administration (see Section 2.1). However, several other considerations were identified in Phase 2 which have bearing on the final selection process.

1. **Clientele.** Seniors aged 80 and over may be a challenging population to work with on a daily basis. DICs routinely encounter a variety of issues which could be either physical or psychological in nature. Elderly drivers are often apprehensive about the licence renewal process and, in some instances, resent that they are required to attend GES. They can also challenge referral decisions as they sometimes believe that DICs are attempting to take their licence away. The inclusion of a cognitive screening tool can further increase anxiety associated with what is already perceived to be a stressful process. Subsequently, screening tool outcomes may be affected by nerves or physical limitations (e.g., tremors – which might be exacerbated during times of stress). With the addition of a screening tool to GES, there is also the potential that seniors and/or their advocates will more often challenge the validity of the results if they fail. For this reason, it is necessary to leave little to no room for discretion in scoring and to take into consideration other factors (i.e., level of participation and understanding of material) when making the final referral decision.

Subsequently, a tool such as the Rey-Osterrieth Test may pose considerable problems for senior participants. The task is relatively complex, as seniors are required to copy a fairly intricate design onto a piece of paper. This task may appear daunting, especially to seniors with vision problems or limited control of motor functions as a result of tremors or arthritis (i.e., they might have difficulty holding a pencil and drawing effectively). The image seniors are asked to reproduce is complex and, as a result, this leaves DICs with a fairly high amount of subjectivity in scoring. Although guidelines are given for the scoring of this particular tool, there is still discretion involved. The greater the discretion in scoring, the greater the potential for result challenges.

Another example of a test that may pose challenges on account of senior physical limitations is the Maze Task Test. Seniors could fail the test not necessarily because of cognitive impairments but simply because drawing smooth and uninterrupted lines on a maze is too difficult. This would be an example of low specificity and a resulting false positive determination of unsafe driving behaviour. On the other hand, it warrants mentioning that the presence of severe motor problems may also be indicative of an increased risk, and for this reason such a test may be appropriate anyway.

2. **Time constraints.** As it stands, DICs have a three hour window in which to administer the vision test, deliver GES, and administer and score the knowledge test. DICs might also be required to conduct oral examinations which are more time consuming. While some sessions finish well within
the three hour timeframe, others run the full span or even exceed this amount of time. The inclusion of a cognitive screening tool will add to the length of time needed to complete the session assuming that no other components are removed – i.e., administration of tool, scoring, review of results with seniors. If the tool takes five to ten minutes to administer and scoring takes approximately two minutes per participant, it is feasible to incorporate the tool into the existing GES framework with minimal changes to program structure and format. The ease with which DICs administer and score the tools will increase over time as they become comfortable with their use. Therefore, administration and scoring will likely take more time at the outset than it will once DICs develop experience. The amount of time it takes DICs at the outset will largely be a function of how much training they receive or the level of intensity of their training.

When conducting the meta-analysis the issue of time constraints was accounted for by coding the cognitive tools based on their duration. Any tool that took longer than 30 minutes to administer was excluded from the meta-analysis (in reality, the selection of tools included only tools that take approximately 10 to 15 minutes to administer). Nevertheless, duration of administration and scoring of these tools in a group setting can only be accurately estimated in actual practice. It is important to note that the estimates of duration are from studies in which the tests were administered to participants individually and often by someone with training in the field of cognition. This will be an important consideration to be taken into account in the pilot phase of this project.

3. Literacy issues. Seniors may have literacy issues, particularly those who live in rural communities. While they may comprehend the information relayed to them during the session and actively participate, these seniors often struggle to complete the knowledge test. DICs often accommodate in these instances by reviewing questions and answers with them orally. This must be taken into consideration for a cognitive screening tool. Instructions must be simple and the tool cannot rely largely on seniors’ ability to read and write to ensure successful completion. An oral explanation by DICs as well as a slide with an animation of an example of how to complete the tool might help mitigate this problem although if DICs have to provide individual explanations this could make the process of administration more time consuming.

For the purposes of this discussion, it may be wise to exclude tools which require participants to read and understand several sentences or comprehend lengthy instructions in order to successfully complete the task. Some tools, such as the Wechsler Digit Symbol Substitution Test require little to no reading to complete. An exam such as the Eight Item Informant Interview on the other hand, requires participants to read through various questions and provide answers. Due to literacy issues, and language issues (discussed next) it would be beneficial to exclude this latter test from the pilot phase; while DICs could administer the tool orally to the group this would increase the time required to complete the task which would make this an undesirable option.

4. Language barriers. Similar to literacy issues, seniors may present with language barriers that can make the completion of written tasks challenging. In metropolitan areas with large numbers of immigrants (such as Toronto), this problem is more pronounced. While the written examination is offered in 17 languages, it may not be feasible to develop various translations of the screening tool (it might not be possible due to copyright infringement either). In order to address this issue for a
cognitive screening tool, a similar solution to the one identified in relation to literacy issues could be implemented (i.e., use of an instructional slide combined with oral instructions from DICs). Seniors with profound language barriers that cannot be accommodated are generally referred to road tests.

5. DIC knowledge, training, and buy-in. In order to successfully implement a screening tool, DICs will require training and must be able to effectively administer and score the tool as well as correctly complete a new version of the Renewal Application form. Moreover, cooperation in the process will be required. While there is general consensus that DICs are likely to be receptive to the addition of such a tool to GES, the corresponding workload implications cannot do any of the following: result in the creation of a multitude of new DIC tasks, lengthen the GES session, or leave referral decisions open to frequent challenge. These issues will have to be addressed in the training component specifically, in addition to training about tool administration and scoring.

The knowledge and training required to administer and score a cognitive screening tool was taken into consideration as part of the meta-analysis. To the best of their ability, coders estimated the difficulty involved in the administration and scoring of each tool. For instance, if the tool is commonly administered using measurements of cognition which require specialized training it would have been eliminated from the list. Similarly, tools which involve complex scoring such as difficult formulas, the use of a computer program, or the weighting and scaling of several scores were also eliminated. Essentially, all of the cognitive screening tools which made it into the top ten are relatively easy to administer and score, except perhaps for the Clock Drawing Test and the Rey-Osterrieth Test, which involve some subjectivity and interpretation of the participants’ drawings. For this reason, it may be best to exclude both of these tools from the pilot phase.

6. Referral authority. DICs currently feel as though they lack the authority to make road test referrals in the absence of either a self-reported condition or overt evidence that there is cognitive impairment present. In other words, DICs believe that they lack the authority to refer seniors to the Medical Reporting Program for a cognitive assessment if there is no disclosure of a condition and they also feel as though they lack justification to refer seniors to the road test based simply on a lack of GES engagement. The inclusion of a cognitive screening tool would provide counsellors with the justification for a referral and increase their confidence in doing so as the tool leaves them less open to challenge than a referral based on observation alone. One decision that must be made is to determine whether a failed cognitive test in and of itself warrants a referral or if the decision should be based on the results combined with observations, senior participation level during GES, and performance on the knowledge test.

Although the top ten tools have exhibited significant ability in predicting the driving behaviour of seniors, these tools are not foolproof and there is always the potential for false positive outcomes (i.e., predicting a senior will drive unsafely when there is no increased chance that this particular senior will drive unsafely) and false negative outcomes (i.e., predicting a senior will drive safely when this senior does have an increased chance of driving unsafely). No cognitive screening tool can correctly predict driving ability 100% of the time, and consequently, it might be prudent for DICs to base their referral decisions on all the information available to them as opposed to reliance on a single tool. In other words, the results from the cognitive screening tool should be considered
in combination with GES participation level and the results from the knowledge test. These decision rules for referral to a road test, however, must be clearly established and consistently applied by DICs across GESs in Ontario to safeguard the legitimacy and fairness of the licence renewal process.

7. Resources. An adequate level of resources is required to implement a cognitive screening tool. The allocation of funding to deliver DIC training, updates to the training manual and GES materials, and potentially the purchase of the tool itself is necessary as well as for the implementation of pilot testing of the tool(s). In the current fiscal climate, budgetary concerns are a reality and with the number of seniors that attend GES increasing annually, it might be necessary to explore the monetary implications associated with the addition of a screening tool to ensure that DICs will have the necessary resources and support available to them. Tools that have expensive copyright fees might be excluded on this basis.
5. RECOMMENDATIONS

After taking into consideration the results from both the Phase 1 Meta-analysis and the Phase 2 GES Review, it is possible to make final recommendations regarding which tools are most feasible for MTO to pilot in Phase 4 of the project. It is clear from the meta-analysis results that the cognitive screening tools that made it into the top ten are able to significantly predict driving ability (it was found that, on average, when cognitive screening tools predict a driver is unsafe, there is a 94% greater chance that this driver will exhibit unsafe driving behaviour). However, each screening tool has its own unique strength in predicting driving ability; moreover, sensitivity and specificity data were often not available. Similarly, each tool fits differently within the parameters of GES. As such, several of the top ten tools can be eliminated on account of their inability to meet practical implementation criteria. For efficiency reasons, we recommend four cognitive screening tools be pilot tested in Phase 4.

The following section describes in detail which four tools are recommended for pilot testing (the Double Cancellation Test is a variation of the Single Letter Cancellation Test which is why the two are presented together for consideration) and why these tools have been selected. Explanations as to why other tools were eliminated are also provided.

Finally, some considerations for the implementation of the selected tools into the GES framework are also included along with an example of what a ‘referral matrix’ might look like that DICs can rely upon to weigh the decision to make road test referrals.

5.1 Tool Selection

The following criteria were used in order to select the most appropriate tools for the pilot test phase. These criteria are followed by a list of the tools not selected for pilot testing along with an explanation as to why they are not feasible options. Finally, the four tools recommended for the pilot testing are described, along with justification for their selection.

5.1.1 Tool selection criteria

1. Select a tool that requires limited training for DICs to administer, interpret, and score.
2. Select a tool that does not rely heavily on an understanding of the English language; in other words, the tool should use clear, concise language and instructions should be brief and easy to understand.
3. Take into account language and literacy barriers when selecting a tool. There cannot be an oral version of the tool and MTO may not be able to produce the tool in various languages as it does with the knowledge test.
4. Take into account the physical limitations of seniors when selecting a tool. Some seniors might fail certain tests on account of impairments that are unrelated to cognitive functioning (e.g., arthritis, tremors).
5. Select a tool that adheres to relatively strict time limits. In order to fit within the existing GES framework, a tool should take no more than five minutes to administer. Managers and seniors identified this as a reasonable amount of time to complete a tool as it is not overly
lengthy but also provides seniors adequate time to calm down and focus. If seniors are given only a minute to complete a tool, it is likely that this will cause them to panic which might be reflected in the results. For scoring purposes, the maximum amount of time that can be devoted to the interpretation of results for each tool is two minutes. DICs have approximately thirty minutes on average before seniors start to hand in the knowledge test which provides a short window in which to score each participant’s test.

6. Select a tool with a high degree of consistency in scoring. The elimination of as much discretion in scoring as possible is important to create uniformity province-wide and to also reduce the likelihood of the appeal of results by seniors or their advocates. Some tools require a certain amount of discretion or interpretation on the part of the administrator; this is not desirable in the GES context. Managers expressed interest in the creation of a single scoring grid that could be uniformly applied by all DICs.

7. Take into account copyright fees or the cost to purchase and/or translate (if possible) certain tools. Costs could potentially be prohibitive. Copyrights may also prevent MTO from making any alterations to the tool such as the creation of different translations.

5.1.2 Tools not recommended for the pilot

Rey-Osterrieth Complex Figure Test. This test requires participants to view a complex figure which they must replicate using a pen or pencil onto a piece of paper. It is not timed.

Reasons for exclusion:

Limitations of participants – due to the possibility that participants may have physical limitations in both their hands (e.g., arthritis, tremors) and their vision, a test which relies heavily on small details and the use of a writing instrument may unfairly disadvantage individuals with these limitations. Participants may shake while trying to draw a straight line or may have difficulty viewing the image which would make it harder to replicate. In essence, this test may produce false positive outcomes (i.e., seniors failing the test not because of cognitive impairments but due to other reasons, not necessarily related to driving ability).

Consistency in scoring – because this test is based solely on the re-creation of a complex image, the scoring is subjective in that the administrator must gauge the accuracy with which participants reproduce the image. This could cause variation among DICs and result in low inter-rater reliability. The subjectivity of scoring associated with this tool may open the door for dispute from participants regarding their final scores. Furthermore, the subjectivity also increases the time it would take to score each tool as there is no simple scoring grid that DICs could use to quickly identify right and wrong answers.

Traffic Sign Recognition Test. This test, which has several variations, measures participants’ ability to recognize traffic signs. The test is delivered in multiple choice format.

Reasons for exclusion:

Replication of knowledge test – this test is too closely related to the material covered in the knowledge test that is already a component of GES. In order to isolate cognitive ability, it would be more beneficial to select a test that does not place such an emphasis on knowledge of road signs.
Language barriers and literacy barriers – in order to ensure that the cognitive tool can be completed quickly and easily administered it is important to reduce the amount of reading required on the part of participants. If the test relies heavily on text and requires seniors to read lengthy instructions, those individuals with language and literacy issues may have difficulty completing the test. As with the previous tool, this would likely lead to false positive outcomes. Also, given that this test is so similar to the GES knowledge test, there is the potential that those with language or literacy barriers would require the tool to be delivered orally, much like the exam. From a time and efficiency standpoint, this is not desirable.

**Charron Test.** This test consists of a piece of paper with 19 pairs of objects and 37 pairs of numbers. Participants are instructed to place a check mark beside all non-identical pairs as quickly as possible.

**Reasons for exclusion:**

Limitations of participants – because the goal of the exam is to finish as quickly as possible, being timed may make some participants nervous and negatively influence results.

Copyright issues – it was extremely difficult to find any material regarding this test, including any samples (a problem which was not an issue for the other tools). It may be best to avoid including a tool in the pilot test which seems the most difficult to obtain.

**Eight Item Informant Interview.** This is a survey which participants complete individually. The survey contains questions such as: Are you experiencing problems with judgment? Are you losing interest in hobbies? Participants can either answer “yes,” “no,” or “don’t know.”

**Reasons for exclusion:**

Language barriers and literacy barriers – in order to ensure that the cognitive tool can be completed quickly and easily administered it is important to reduce the amount of reading required on the part of participants. If the test relies heavily on text and requires seniors to read lengthy instructions, those individuals with language and literacy issues may have difficulty completing the test. As with the previous tool, this would likely lead to false positive outcomes and/or increase in the number of oral examinations or referrals for on-road tests.

Ability to alter answers – because the test requires seniors to reflect on their own cognitive abilities, there is room for them to tailor their answers to be more desirable. As well, they may not be aware of certain difficulties they have, making this test more relevant when it is filled out by someone close to the driver such as a caretaker or family member.

**5.1.3 Tools recommended for the pilot**

The following four tools (Single and Double Letter Cancellation Tests are considered one option given their similar nature) have the best balance between safe driving predictive value and feasibility of inclusion in GES. Each of the following screening tools is especially suitable for administration in a group setting and meets a variety of other practical implementation considerations. These are the cognitive screening tools recommended for use in the pilot testing phase.
**Wechsler Digit Symbol Substitution Test (DSST).** The participant is presented with a list of numbers 1-9 with a unique symbol under each number. Organized into rows underneath are several dozen numbers overtop blank boxes. The participant must insert as many of the unique symbols associated with each of the numbers in the rows as possible within a 90-second timeframe.

**Predictive value:**
This tool ranked fairly high in the meta-analysis for its predictive value, making it a highly favourable choice for the pilot. From the studies utilized in the meta-analysis, the DSST has a sensitivity of 91.7% and a specificity of 81.2%.

**Feasibility:**
Although there is a time limit for this test, which may cause nervousness for participants, it is not an overly restrictive time limit given the task. Due to the fact that this test ranked high in predictive value, it is worth considering its inclusion regardless of the time restriction. This task does not rely heavily on the motor abilities of participants (e.g., writing is limited in that they only need to fill in numbers in a row and there is no intricate drawing involved) and there is minimal reading required which limits the extent to which language or literacy barriers could hinder performance.

The test is easy to score (it only involves counting errors) and could be standardized to create a high level of inter-rater reliability. The lack of subjectivity in scoring also makes it more difficult to challenge test outcomes. As a result of the tool’s overall simplicity, little training is required for DICs to be able to effectively administer and score it. Furthermore, the length of time needed to complete the test adheres to the time constraints identified for GES.

**Single Letter Cancellation/Double Letter Cancellation Test.** The Single Letter Cancellation Test consists of a regular-sized piece of paper with six lines of 52 letters. Participants are instructed to cross out the letter ‘H’ whenever it appears in the rows (the letter ‘H’ is presented 104 times). The Double Letter Cancellation Test requires participants to cross out two letters instead of one. Participants are presented with a regular-sized sheet of paper containing six lines of 52 letters. They are instructed to cross out the letters ‘C’ and ‘E’ whenever either one appears (‘C’ and ‘E’ are presented 105 times combined). No time limit is given for the test.

**Predictive value:**
The Single Letter Cancellation and Double Letter Cancellation Tests scored much lower in predictive value in comparison to the other eight tools and unfortunately, sensitivity and specificity values were not available for these tools. Regardless, they still have significant ability in predicting driving behaviour.

**Feasibility:**
Although the predictive value may not be as strong for these tools, they are acceptable options for the pilot test because they meet all of the practical GES implementation considerations. These tests require minimal motor skills (seniors would only be required to cross out letters as opposed to write or draw). Both tests are easy to administer and involve limited reading and require brief instructions.
which accounts for language and literacy barriers. A visual example in the form of a slide that demonstrates how to properly complete the test is one strategy to assist in the administration of the tool.

The scoring of these tests is also very straightforward. DICs could be provided with an overlay scoring grid that would very easily allow them to count missed or incorrect answers. This would create high inter-rater reliability and all but eliminate challenges to tool results. The feasibility of the inclusion of either of these tools into the existing GES framework is very good on account of the limited time required to complete the test, its straightforward nature, and the ease and consistency with which it can be scored.

**Visual Form Discrimination Test.** The Visual Form Discrimination Test is a brief, multiple choice test which consists of two sample questions and 16 test questions. Each question has the following format: a simple design (referred to as the ‘target’) is positioned above five answer options (referred to as ‘stimuli’). One of the four stimuli matches the target exactly, and this is the correct answer. The remaining three stimuli contain minor variations, including rotation of peripheral elements or distortions of a major shape. Participants must indicate, for each of the 16 test items, which stimulus corresponds to each target.

**Predictive value:**

The predictive value for the Visual Form Discrimination Test was low according to the rank-ordering in the meta-analysis. Sensitivity and specificity were not available for this tool. Although it is ranked low, this does not mean it does not have any predictive value overall (i.e., the overall predictive value of this test as part of a group of tests in the meta-regression was significant).

**Feasibility:**

The Visual Form Discrimination Test is feasible to incorporate within the GES framework primarily because it does not have much reliance on participants’ motor skills (the test is multiple choice and does not require participants to write or draw) and there is little reading required as the test involves the comparison of images. Therefore, language and literacy issues are not barriers to this tool’s inclusion. Also, this test is not timed which means that participants have an adequate amount of time to complete the task without feeling overly rushed. It is also short enough to be completed and scored within the identified GES time constraints.

Due to the simplicity of the test, it is relatively simple and quick for DICs to score. There is an answer key for the correct answer to each question, which makes scoring uniform and subsequently, inter-rater reliability high. It also reduces the likelihood that participants or their advocates will challenge the outcomes. Moreover, because the test is multiple choice, limited DIC training to administer and score the tool would be required.

**5.1.4 Tools to consider for the pilot**

The Maze Task Test and the Clock Drawing Test have higher predictive value and were considered for exclusion based on the concern of managers who believe there is the possibility that seniors with motor impairments might not be able to successfully complete them (which according to this perception, could potentially result in a false positive outcome). However, in the absence of
evidence, the likely prevalence of such physical limitations is not clear. Furthermore, it can also be argued that having such a condition that causes a significant motor deficit could put older drivers at a heightened collision risk. As a result, MTO might wish to consider the feasibility of the selection of these tools for inclusion in GES based on weighing their predictive value against other practical considerations.

It should be noted that the Clock Drawing Test (refer to subsection below) scored the highest of all ten tests for predictive value in the meta-analysis. However, this tool could be excluded for reasons other than the motor impairment issues. Implementation of this tool might not be feasible due to potential inconsistencies in scoring across the province and because DICs are likely to require more than two minutes to score each tool.

**Maze Task Test.** This test requires participants to complete a standardized maze. They are instructed to draw a route from entrance to exit without crossing any solid lines in order to complete the maze. This test is timed and must be completed in less than 61 seconds.

**Predictive value:**
This tool was ranked fairly high in the meta-analysis for its predictive value. Also, it has a sensitivity of 77.8% and a specificity of 82.4%.

**Feasibility issues:**
Limitations of participants– due to the possibility that participants may have physical limitations in both their hands (e.g., arthritis, tremors) and their vision, a test which relies heavily on small details and the use of a writing instrument may unfairly disadvantage individuals with these limitations. Participants may shake while trying to draw their path through the maze, causing them to cross over solid lines or they may have difficulty seeing the maze which would make it harder for them to draw a path to an exit. Furthermore, it could be stressful for participants to work within a time limit, making them nervous and unable to perform to the best of their abilities.

**Clock Drawing Test.** This test requires participants to draw a clock onto a blank page and satisfy specific criteria – i.e., it needs to be a certain size, indicate a certain time, and adhere to the general characteristics of a common clock.

**Predictive value:**
This test had a very high predictive value according to the rank-ordering in the meta-analysis. Also, this was the only test for which three data points were available; all three of them are consistently high in terms of predictive value. This test has a sensitivity of 64.2% and a specificity of 97.7% according to the information from one evaluation study. According to another study sensitivity was 70% and specificity 65%.

**Feasibility issues:**
Consistency in scoring – because this test is based solely on the recreation of a complex image, the scoring is more subjective in that the administrator must gauge the accuracy with which participants reproduce the image. This could cause variation among DICs and result in low inter-rater reliability (which speaks to the importance of uniform training). The subjectivity of scoring may
open the door for dispute from participants regarding their final scores. Although there is an answer key developed for this test (i.e., descriptions of the criteria each portion of the clock should meet) there is still more discretion in scoring the test compared to other tools.

Limitations of participants – due to the possibility that participants may have physical limitations in both their hands (e.g., arthritis, tremors) and their vision, a test which relies heavily on small details and the use of a writing instrument may unfairly disadvantage individuals with these limitations. Participants may shake while they attempt to draw the circle and the numbers within the circle or may have difficulty seeing what they are drawing.

5.2 Implementation considerations

The following recommendations can be used to guide the implementation of the selected cognitive screening tool(s) within the current GES framework during the pilot phase of the project.

**Updates to GES materials**

- An update to existing GES material would need to be done to reflect the inclusion of a cognitive screening tool. This includes updates to the DIC manual and Renewal Application form. With regards to the DIC manual, instructions related to the following should be included:
  - Explanation of cognitive screening tool to GES participants;
  - Administration of cognitive screening tool;
  - Scoring of results;
  - Review of results with seniors;
  - Completion of corresponding section on the Application Renewal form (indicating whether the tool indicated a cognitive functioning issue); and,
  - Referral to road test if necessary.

**DIC support**

- In order to gain DIC buy-in and support for the inclusion of a cognitive screening tool, MTO could present the minimal increase in workload as a trade-off for increased referral authority. The premise of the inclusion of a cognitive tool is aligned with what most DICs want – i.e., to identify those seniors who are at high-risk of collision and refer them for a road test or possibly for a medical assessment to protect public safety.

**Administration of tool**

- The most appropriate time to administer the cognitive screening tool is immediately after the education session has ended. The tool could also be administered to the group following the vision test although managers identified this as a less favourable option from a logistical viewpoint. However, if the vision test is eliminated from GES (i.e., seniors are
required to bring verification of an eye examination to the session) this will provide even more time to administer the cognitive screening tool.

> It is also important to take into consideration the stress placed on seniors who attend GES. The more tasks they are required to complete, the more demanding the process will become and the more their anxiety could increase. As a result, it might be favourable to incorporate the cognitive screening tool at the beginning of the session. This consideration has to be balanced against its feasibility from a practical standpoint.

> An instructional slide that includes animations of how to complete the tool could be created and added to the GES PowerPoint presentation. This slide would help DICs explain to seniors what is required of them and the visual demonstration could mitigate language and literacy barriers as seniors could look to the example for guidance.

> The manner in which the administration of the tool is framed and presented to seniors is an important consideration. It might be beneficial for DICs to emphasize that the tool is merely meant to provide an indication as to whether cognitive impairments exist and that the outcome alone in no way will automatically result in the loss of the driver’s licence. The tool is one additional element of the licence renewal process that can help identify senior drivers who might be at a heightened risk of collision.

**Scoring of tool**

> DICs could score the cognitive tools while they wait for seniors to complete the knowledge test. DICs typically have a thirty minute window before the first knowledge test is turned in. Also, seniors do not all hand in their tests at once which provides additional time to score the tool and record the results for each of the participants.

**Referrals**

> A determination should be made as to whether the failure of the cognitive screening tool alone automatically triggers a referral to the road test. Managers expressed concern that using the tool as a referral mechanism in and of itself might be met with resistance. As such, a more acceptable approach might be to create a referral matrix in which DICs take into account the results of the tool, participation level during the education session, and performance on the knowledge test prior to making a referral decision. For those cases where DICs believe a referral is necessary, the results of the tool could help strengthen the justification for the decision.

  » Regardless of the referral criteria adopted and the weight given to the tool results, the decision triggers need to be objective and uniformly applied by DICs across the province to ensure fairness, and to minimize challenges by seniors and/or their advocates. The idea of a decision matrix is explored in more detail in the following section.
5.2.1 Referral matrix

As part of the consideration process for the implementation of cognitive screening tool(s) in GES, decisions regarding the weight ascribed to tool results in relation to road test referrals must be made. As mentioned previously, cognitive screening tools have different predictive values. It is therefore acknowledged that, ideally, the decision for referral should not be based solely on the results from a screening tool. Managers supported the notion of DICs taking into account various elements of GES in order to arrive at a final referral decision. Consequently, it may be beneficial for MTO to implement a referral matrix, which would enable DICs to weigh different pieces of information to determine whether a road test is necessary for a particular senior driver. The following is an example of how a matrix may be constructed.

Figure 2: Example of a GES referral matrix

<table>
<thead>
<tr>
<th>Participant’s Name:</th>
<th>Automatic referral to road test on account of demerit points or collisions on the driving record: YES NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving record</td>
<td></td>
</tr>
<tr>
<td>Knowledge test</td>
<td>Score: PASS FAIL (circle one)</td>
</tr>
<tr>
<td>Cognitive tool</td>
<td>Score: PASS FAIL (circle one)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participation level</th>
<th>Rate the participant’s participation (circle one):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. No participation: unaware and uninvolved, did not contribute.</td>
</tr>
<tr>
<td></td>
<td>2. Some participation: awareness but uninvolved, no contribution</td>
</tr>
<tr>
<td></td>
<td>3. Average participation: aware, involved, small contribution</td>
</tr>
<tr>
<td></td>
<td>4. Good participation: very aware, somewhat involved, contributed</td>
</tr>
<tr>
<td></td>
<td>5. Excellent participation: very aware, fully involved, several contributions</td>
</tr>
</tbody>
</table>

Final recommendation: Should the participant be referred to a road test? YES NO (circle one)

Seniors would be required to achieve an acceptable score based on the completion of each GES component. For example, if the participant passes in three of the four areas in the matrix, a decision rule in this matrix could be to allow them to renew their licence without taking the road test. Such a decision matrix and accompanying decision rules would need to be developed for DICs.
REFERENCES


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