Canadian Task Force
on Preventive Health Care
e: info@canadiantaskforce.ca
w: www.canadiantaskforce.ca

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Screening for impaired visual acuity and vision-related functional limitations in adults 65 years and older in primary health care: Systematic review

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University of Alberta Evidence Review Synthesis Centre
ERSC Project Lead Investigator: Lisa Hartling
ERSC Project Staff: Jennifer Pillay, Tara MacGregor, Robin Featherstone (Research librarian), Ben Vandermeer (Statistician)
ERSC Experts: Ellen Freeman PhD, and William Hodge MD, PhD, FRCSC

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Author contributions:

JP, LH, EF, WH, RF, and BV contributed to protocol development. RF designed and implemented the database search strategy and conducted grey literature searches. TM led the screening and quality assessments and contributed to data extraction and GRADE assessments. JP contributed to study selection, quality assessments, and GRADE assessments, and verified all data extraction. EF, WH, LH and BV provided methodological expertise for data analysis and interpretation of findings. JP, EF, and LH contributed to discussions with the CTFPHC and PHAC who provided feedback on the draft report and interpretations of the findings. JP and TM drafted and EF, WH, RF, BV, and LH critically reviewed the report.

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protocol and approved the final report. The ERSC is responsible for study selection, data collection, analysis and preparation of the manuscript of the review while the CTFPHC and GHGD provided input into the interpretations of the findings. The ERSC takes final responsibility for the content of the review.

CTFPHC Working Group: Brenda Wilson (Chair), and the following members: Brett Thombs, James Dickinson, Scott Klarenbach, Maria Bacchus

PHAC GHGD Staff: Susan Courage, Alejandra Jaramillo Garcia, Nicki Sims-Jones

The following individuals represent content experts and stakeholders that reviewed a draft version of this report during March 2017. The ERSC considered all input when finalizing the report and responses to comments were sent to all reviewers. The conclusions and synthesis of the scientific literature presented in this report does not necessarily represent the views of individual reviewers.

Mathieu Carignan
Canadian Occupational Therapy Low Vision Rehabilitation Network

Walter T. Delpero, MD, FRCSC
Assistant Professor
Department of Ophthalmology
University of Ottawa

Natasha Kuran
Manager, Senior Policy Unit
Public Health Agency of Canada

Matthieu Lafontaine-Godbout, MD
Assistant Professor at the Faculty of Medicine and Health Sciences
University of Sherbrooke

Susan J. Leat, PhD, FCOptom, FAAO
Professor, School of Optometry and Vision Science,
University of Waterloo

Professor Stephen Lord
Senior Principal Research Fellow
Falls, Balance and Injury Research Centre
Neuroscience Research Australia

Karen McCormac, BN
Canadian Nurses Association
Director, Quality and Patient Safety
Misericordia Health Centre

Linda S. Petty, BSc(OT), OT Reg (Ont)
Assistive Technology Consultant
Accessibility Services, University of Toronto Scarborough

Dr. Gilles Plourde
Senior Clinical Evaluator, Health Canada

Dallas Seitz, MD, FRCPC
Assistant Professor
Queen's University

Kimberley Simmonds, BSc, MMSc, PhD
Alberta Health

Enitan Sogbesan
Assistant Professor, Ophthalmology – Glaucoma
McMaster University

Benoît Tousignant OD, MSc, MPH, FAAO
Assistant Professor, School of Optometry
University of Montréal

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Summary

Background: In developed countries, impaired visual acuity typically affects about 10% of people aged 65 to 75 and 20% over 75. Although uncorrected refractive error is the most frequent cause of impaired visual acuity throughout adult life, other conditions such as cataract, macular degeneration, diabetic retinopathy, and glaucoma also become frequent causes in older ages. This review focuses on screening by primary care professionals (but not eye care professionals) for visual acuity or vision-related functional limitations in order to help identify refractive errors, cataracts, and macular degeneration; glaucoma assessment requires equipment (e.g., for visual field testing and viewing the optic nerve) and expertise only infrequently available in a primary care setting, and testing for diabetic retinopathy is considered case finding (rather than screening) by specialist practitioners within a group of people with a high risk of acquiring the condition. While treatment for refractive errors and cataracts is effective without great concern about major harms, 11% to 51% of older people appear to have unrecognized, correctable impaired visual acuity (<20/40) and may benefit from screening in primary care in order to coordinate care with eye professionals or other services and programs.

Purpose: This review was produced for the Canadian Task Force on Preventive Health Care (CTFPHC) to help inform their recommendations on screening for impaired visual acuity or vision-related functional limitations in older (≥65 years), community-dwelling adults in primary health care settings.

Review Approach: Following CTFPHC methods, a staged approach was used, applying Grading of Recommendations Assessment, Development and Evaluation (GRADE) methods. The quality of the evidence was determined for outcomes rated by the CTFPHC, using input from consultations with older adult Canadians, as important or critical for decision making: benefits included reduced mortality, fractures, loss of independence, vision-related functional limitations/quality of life, impaired visual acuity; harms included serious or major adverse effects from treatment, and anxiety/burden from diagnosis if limited or inaccessible treatment options for the condition. Evidence was first sought on the clinical effectiveness of screening in primary health care; these studies would compare outcomes over time between a control group of no screening/usual care, and an intervention group for which there is an intent to screen all people and, if indicated, encourage them through referrals or otherwise to seek further assessment by eye professionals and possibly treatment or other services to improve their vision and/or other patient-important outcomes related to vision. A hierarchy of evidence was used with randomized controlled trials (RCTs) reviewed first if available. If screening was found to have a favorable benefit-harm ratio from a body of high-quality evidence, we would have examined its cost-effectiveness; we would have examined patient valuation of benefits and harms if the evidence on clinical effectiveness left considerable uncertainty about the balance of benefits and harms. Additionally, if insufficient (e.g., very low-quality) evidence on clinical effectiveness existed, we would have sought evidence on screening test accuracy to provide indirect evidence about screening programs. The body of evidence from RCTs on the clinical effectiveness of screening older adults in primary health care settings is reported in this report; no other systematically reviewed evidence is determined necessary at this time for the CTFPHC to make a recommendation.

Data Sources and Study Selection: Four high-quality systematic reviews on vision screening, home visits, and preventive health care were identified, and we largely relied upon these for identifying studies reported before 2012. To update the evidence, we searched MEDLINE; Embase; Cochrane Library; CINAHL; and PubMed to October 2017 using terms highly sensitive for screening for vision, alone or within multicomponent assessments. Supplementary searches for grey literature were conducted (internet-based searches, electronic libraries, trial registries, and references supplied by stakeholders), and reference lists of other systematic reviews (n=25) and included studies were reviewed. Two reviewers independently screened titles and abstracts of citations. Full texts of studies that were classified as "include/unsure" by either reviewer were retrieved and screened independently by two reviewers using a standard form with explicit inclusion and exclusion criteria. Disagreements were resolved through consensus or consultation with a third reviewer. The flow of literature and reasons for exclusion after full-

text review are documented. Authors of papers, where vision screening was not explicitly stated (but indicated in some manner) or outcomes were not reported, were contacted to obtain information and data on our outcomes of interest.

Data Extraction, Analysis, and Interpretation: One reviewer independently extracted data, and another reviewer verified all data from each included study. Two reviewers independently assessed the risk of bias of each included study. We performed random-effects meta-analyses where appropriate, and performed sensitivity and subgroup analysis based on *a priori* variables for patient and intervention characteristics. Data on within-study analysis on our subgroups of interest were also collected. For calculating the absolute effects for dichotomous outcomes, we used the relative risk and the median baseline risk for the control group in the included trials. We examined funnel plots and conducted Egger's test to detect small-study bias when there were at least eight studies in a meta-analysis. When data could not be pooled, we provide a narrative summary of findings. Two reviewers independently assessed the quality of the body of evidence using the GRADE methodology, with consensus based on discussion and third-reviewer input. The evidence is summarized in GRADE Evidence Profiles and Summary of Findings tables. We chose to use standard wording to communicate our interpretations of the quality of evidence, which reflects the degree of certainty we have in the effects. For findings supported by high, moderate, low, and very low quality evidence we use "will", "probably/likely", "may/appears to", and "not known/very uncertain", respectively, in our textual descriptions of the results.

Results: Our database searches from 2012 to October 2017 identified 14,995 citations after duplicates were removed; an additional 146 records were eligible for full text review from other searches. After all full text review (n=452) including author contacts when information was needed for determining eligibility, we included 15 RCTs reporting on 17,400 participants. Trials were conducted in a variety of settings although mostly in physician offices or participants' homes. None of the trials exclusively enrolled participants not having regular eye care providers. Only two of the 15 RCTs had an isolated vision screening intervention, whereas all others incorporated vision screening within a multicomponent assessment of health and functioning. Screening involved the use of questions on one or more presenting vision problems in 10 trials and objective tests measuring presenting visual acuity with or without other visual function testing in the other five. The number of healthcare interactions after screening ranged between 1 and 12. Follow-up ranged from 2.5 to 47 months (mean 18.6 months); studies with longer follow-up usually had more interactions. Only four trials reported specific screening criteria/thresholds for referring participants to eye professionals. Most only provided referrals or follow-up when participants reported that they did not have a regular eye care provider. For subjective outcomes from 11 RCTs, the overall risk of bias was considered high mostly due to lack of blinding of participants (n=8) or outcome assessors (n=11). Four of five RCTs reporting on objective outcomes were at unclear risk of bias; one had high risk of bias due to incomplete outcome data (>30% attrition of those alive at follow up and/or large differential between groups). As would be expected for trials in this age group, attrition was moderately high in several studies.

Benefits and Harms. Because the outcomes of mortality, fractures, and loss of independence could not usually be attributed to the vision component of the multicomponent interventions, the trials provided no or scarce evidence for these outcomes. Two trials (n=1,180) reported on a surrogate outcome for fractures (falls and falls requiring medical treatment) that were attributed to vision screening (i.e., via isolated vision intervention or other attribution by study authors) over follow-up durations of 12 to 18 months. The quality of evidence for fractures was assessed by GRADE methods as very low, and therefore we are very uncertain about the effects of screening with multiple vision tests on fractures over medium-term follow-up. Low-quality evidence from one RCT (n=1,807; median 3.9 years follow up) showed that screening with objective tools (logMAR chart with pinhole correction) of visual acuity may make little or no difference in vision-related functioning over long-term follow-up (NEI-VFQ-25, range 0-100; minimally important difference 4-6 points; mean difference, 0.4 units higher for screening; 95% CI, -1.25 to 2.05 units). Screening with multiple objective vision tests probably makes little to no difference in high-contrast, distance visual acuity for older adults over medium-term follow-up (minimally important

difference 0.1 logMAR; 4 RCTs; n=1,236; mean difference, -0.01 logMAR; 95% CI, -0.05 to 0.03). Quality assessment (1 RCT; n=519) found that screening with multiple objective vision tests may reduce worsening (RR 0.55, 95% CI 0.39 to 0.78; absolute effect, 126 fewer per 1000; 95% CI, 62 to 171 fewer) and/or improve (RR, 1.82; 95% CI, 1.08 to 3.08; absolute effect, 73 more per 1000; 95% CI, 7 more to 185 more) high-contrast, distance visual acuity by at least 0.1 logMAR (minimally important difference) for a proportion of older adults over medium-term follow up. We are very uncertain about the effects of screening using tests of visual acuity on the proportion of people no longer having impaired visual acuity (worse than 20/60) in both eyes or in either eye over long-term follow-up (1 RCT; n=1,807). Screening with objective tools may make little to no difference in the proportion of people having bilateral impaired visual acuity worse than 20/40 over medium-to-long term follow-up (2 RCTs; n=1,967; RR, 0.82; 95% CI, 0.66 to 1.02; absolute effects, 67 fewer per 1,000; 95% CI, 7 more to 127 fewer). It may make little to no difference in the proportion having impaired visual acuity worse than 20/40 in either eye over long-term follow up (1 RCT; n=1,807; RR, 0.98; 95% CI, 0.82 to 1.17; absolute effect, 15 less per 1000; 95% CI, 108 less to 102 more). Ten RCTs reported on the outcome of self-reported vision problems using non-validated questions. Moderate quality evidence from 10 RCTs (n=8,683) comparing screening using self-reported vision with no screening or usual care found no significant difference for self-reported vision problems (RR, 0.97; 95% CI, 0.90 to 1.05; absolute effect, 9 fewer per 1,000; 95% CI, 16 more to 31 fewer) over a median follow-up period of 20 months. Most of our planned subgroup analyses—follow-up duration, screening personnel, setting, and type of screening tool—did not appear to explain the heterogeneity in the effects for this outcome. One subgroup analysis with some credibility compared studies of relatively younger patients (mean age <75 years) who were completely independent in activities of daily living (ADLs) (3 RCTs; n=5,269) with those of older patients (e.g., 75 and older) with some reliance on others for ADLs (7 RCTs; n=3,414) (self-reported vision problems: RR, 0.85; 95% CI, 0.76 to 0.96 vs. RR, 1.03; 95% CI, 0.96 to 1.11, respectively; p=0.008 between groups; I^2=0% for each). No trial reported on any of harm of interest.

Implementation Factors. From data of seven RCTs, about a third (median 35%) of patients screening positive for vision problems were referred to eye professionals, although the range of 29 to 95% was large. In total for these seven trials, there were 574 referrals provided to 3,225 screened patients (18% of those screened). Reasons for not referring provided by several trial authors were mostly related to patients reporting care by eye professionals. The uptake of referrals (5 RCTs reporting) was moderate (median 68%; range 18-96%). One additional trial reported similar compliance (68%) to any of multiple recommendations (visit eye professional, wear hat/sunglasses in high-glare situations, turn light on at night). Over the five trials reporting on referral uptake (n = 3,063 screened), 231 patients (7.5%) likely received further assessment for their vision via referrals. This number may not represent those getting treatment; for example, in one RCT, 26 of 101 complying with referrals (5% of screened population) received treatment (20 new glasses and 6 surgeries). In another, only 2% of screened patients received new glasses or cataract surgery.

Limitations: There should be some consideration that the trials did not focus only on patients with unrecognized vision problems (e.g., many reported current care by an eye professional), and that the absolute effects may have been different if the study investigators had excluded these patients, thus changing the baseline rates of impaired vision. The results, though, may best represent a typical primary care setting where a vision screen may be given to all patients. Further, in 10 of the trials the control group patients had some form of vision assessment (for outcome comparison), and in at least one trial some patients received referrals to eye professionals; results across many outcomes may underestimate what may occur should a practitioner newly initiate screening and referrals into practice. Although several trials included assessment of factors that could theoretically affect vision if treated (e.g., medication review, nutrition assessment) we are making the assumption that the vision screening and subsequent care by eye professionals, would have been the largest contributor to any beneficial effect on vision. Although we report on differential effects for an *a priori*-defined subgroup for the outcome of self-reported vision problems, between-study analyses based on study-level patient variables are observational in nature with the potential for an ecological fallacy and confounding by other between-study differences. The

credibility of this subgroup effect is not considered high, and the magnitude of the difference between sub-groups is considered low quality evidence. Further research is warranted to determine if these effects are valid.

Conclusions: Evidence was either not found or of low quality for most outcomes considered most critical for decision making by the CTFPHC for screening for impaired visual acuity or vision-related functional limitations for older, community-dwelling adults in primary health care settings. No evidence was found for mortality, loss of independence, or critical harms; the quality of evidence available for the outcome of fractures was very low such that we cannot make any conclusions on the effects. Screening probably makes little to no difference for mean visual acuity over medium-term follow-up across populations of older adults. It may also make little or no difference for vision-related functional limitations and we have no certainty about effects on the number of patients with impaired visual acuity meeting clinically relevant thresholds (e.g. worse than 20/60). Low quality evidence suggested that there may be some benefit in the numbers of patients having their vision worsen or improve by a marginal degree (0.1 logMAR=5 letters). For an added outcome of self-reported vision problems, screening probably makes little to no difference; studies where the average patient age was relatively younger (< 75 years) and all patients were independent in ADLs at baseline showed a greater effect for this outcome than those of older patients with at least some requiring assistance with ADLs, although other confounding factors may exist between these groups of studies and the findings are considered exploratory and in need of more research. The results of largely no effect across outcomes could relate in part to a fairly low referral rate by clinicians for those patients screening positive (due to reports of regular eye professional care), moderate uptake of referrals by patients, and low numbers of patients receiving treatments. Findings are most applicable to screening all older adults in primary care, and not for those seeking and receiving care by eye professionals or other providers working in visual rehabilitation settings where comprehensive assessments and treatment/services would be directly provided.

PROSPERO Registration #: CRD42016053088

Section I. Purpose and Background

The purpose of this review was to examine the evidence on vision screening of community-dwelling older adults (ages ≥65 and not under the care of an eye professional) within primary health care. The findings will be used by the Canadian Task Force on Preventive Health Care (CTFPHC)—supplemented by consultations with patients and stakeholder on issues of feasibility, acceptability, costs/resources, and equity—to inform recommendations to support primary care providers in delivering preventive health care.

Background

The prevalence of impaired visual acuity and vision-related functional limitations in the world is high. In World Health Survey data from 70 countries (not including Canada), 21% of adults overall reported difficulty in "recognizing a person you know across the road"; this proportion varied by country income status with high-income countries having a prevalence of 13%.[1] In 2007, the total financial cost of vision loss in Canada was estimated at $15.8 billion, and its prevalence was projected to double by the year 2032 due to changing population demographics.[2] Prevalence of impaired visual acuity increases with age. Impaired visual acuity and other problems within the visual system negatively impact vision-related functioning, quality of life (QoL), and likely mental health;[3,4] in older adults this manifests through various effects such as decreased participation in social and leisure activities, difficulty in family relationships, and injuries from accidents including falls.[5-15] They also affect instrumental activities of daily living (IADLs), or ability to work, drive safely, or maintain a driver's license, therefore limiting independence.

Terms, Definitions, and Scope of Screening in Primary Care

Visual acuity refers to the sharpness or clarity of vision. Impairment in visual acuity may be caused by problems with the sharpness of the image reaching the retina (e.g. refractive error, media opacities such as cataract), by retinal disease, or by the central processing or interpretation of visual neural signals. The World Health Organization (WHO)[16] uses presenting distance visual acuity to classify individuals into categories of mild or none [≥20/60], moderate [<20/60 to ≥20/200], severe [<20/200 to ≥20/400] visual impairment, with blindness defined as a visual acuity worse than 20/400; the term low vision (replaced by moderate and severe impairment) is not used within the WHO classification any longer, to avoid confusion with the need for low

vision care which often occurs at a less severe threshold of visual acuity and is often not specific to visual acuity.[17,18] The WHO classification is not always used, particularly in studies from North America which define visual impairment at worse than 20/40, when some form of vision-related functional limitation often begins, and legal blindness at 20/200 or worse.[19-22] Depending on the jurisdiction, in Canada poorer than 20/40 or 20/50 serves as the acuity required for an unrestricted driving license.

Although visual impairment is typically defined by degree of impaired visual acuity, this term may also be used to refer to other problems with visual function (e.g., visual field loss—areas in the field of view/peripheral vision in which objects cannot be seen, lowlight vision, colour vision, contrast sensitivity, binocularity).[18] Likewise, findings related to visual acuity (e.g., severe inability to see, blindness) may be interpreted in terms of vision disability[23] which more often refers to activity or functional limitations resulting from one or more problems in the visual system. For this review, we will use the term *impaired visual acuity* when referring to loss of visual function measured in terms of visual acuity and meeting WHO or North American thresholds (<20/60 or <20/40); we will use *vision-related functional limitations* when referring to functional deficits such as inability to drive or perform IADLs (e.g., handle finances, take medication) directly resulting from impaired visual acuity and/or other functional or structural problems within the visual system. Other outcomes, to which vision loss may contribute, are defined as *potential adverse consequences of vision loss*, such as falls, fractures, depression, cognitive decline, loss of independence.

These terms (*impaired visual acuity, vision-related functional limitations, potential consequences of vision loss*) align with a focus on screening tests used most often within primary care, including visual acuity charts and structured screening questions or tasks focusing on vision-related function (e.g., problems with reading, driving); they also align with the outcomes chosen for this review. When tests or outcomes (e.g., contrast sensitivity) are used that do not fall into these categories we will use the terminology reported by the authors.

The CTFPHC uses the Institute of Medicine's definition of primary care as, "the provision of *integrated, accessible health care services* by *clinicians* who are *accountable* for addressing a large *majority of personal health care needs*, developing a *sustained partnership* with *patients*,

and practicing in the *context of family and community.*"[24] The main clinicians involved are individuals who use a recognized scientific knowledge base and have the authority to direct the delivery of personal health services to patients. The CTFPHC's main audience is primary care physicians and nurses, although the Task Force recognizes the importance and relevancy of their recommendations to community and public health professionals (public health nurses, nutritionists), physician specialists, other health care and allied health professionals. This view also aligns with Health Canada's functional definition of primary *health* care: (i) to direct provision of first-contact services (by providers such as family physicians, nurse practitioners, pharmacists, and telephone advice lines); (ii) to coordinate care to ensure continuity and ease of movement across the system, so that care remains integrated when Canadians require more specialized services (with specialists or in hospitals, for example); and to include other care models such as community health centres, public health nurses, well baby clinics, and the inclusion of non-medical health care providers with a focus on health promotion.[25,26]

For this guideline, we acknowledge that optometrists regularly provide first-contact services and are considered primary health care practitioners of the eye and visual system, but they are considered to be outside the scope of this review which is focusing on whether practitioners without considerable eye training or specialized equipment should routinely conduct limited screening for potential vision problems. Rather, we are considering that assessment by an optometrist could be advised or arranged by other primary health care providers should screening indicate the need for further testing and/or treatment. For clarity, throughout this document we use the term *primary care* consistent with the Institute of Medicine's definition with focus on professionals covering a wide range of personal health care needs. We use the term *eye professional* to indicate optometrists or ophthalmologists.

Prevalence and Incidence of Impaired Visual Acuity in an Aging Population

Several studies in Canada and other developed countries have documented the prevalence of impaired visual acuity in older populations. In 2006, 13.4% of Canadians aged 75 years and older reported having a "seeing limitation"; more older (aged 75 and older) than young people (aged 15 to 24) with limitations said they were severe (30.5% vs. 16.7%).[27,28] A more recent study found prevalences of habitual/presenting (with current spectacles) impaired visual acuity (<20/40) of 3.9% (95% confidence interval [CI], 1.9 to 8.1; 60-69 years) and 7.5% (95% CI, 3.1 to 16.9; >80 years) and an overall reduced visual acuity (<20/25) prevalence of 15.2% (95% CI

12.8 to 18.0); an odds ratio (OR) of 3.56 (95% CI, 1.22 to 10.35) was found for impaired distance visual acuity in older (≥65 years) versus younger (39 to 64 years) people.[21] Apart from increasing age, the only demographic variable significantly associated with distance and near visual acuity in this study was increased time since last eye examination. In general, reports from developed countries including the United States (U.S.) and United Kingdom (U.K.) suggest that impaired visual acuity typically affects about 10% of people aged 65 to 75 and 20% over 75.[29-32] Large studies the U.S., Australia, and Europe have found the prevalence of impaired visual acuity to increase dramatically (up to three-fold) over the age of 60;[33-35] one in the U.S. found that 75 year olds were 12.8 times more likely (95% CI, 9.6 to 17.1) to develop impaired visual acuity over 15 years than those younger than 75 years.[36] Residents of nursing homes are reported to have at least three times higher levels of impaired visual acuity than community-dwelling older adults of similar ages.[37-39]

Etiology and Treatment for Conditions Causing Visual Impairment

Although uncorrected refractive error is the most frequent cause of impaired visual acuity,[21,40,41] cataract, macular degeneration, diabetic retinopathy, and glaucoma are the next most frequent causes and predominate as causes of visual impairment in older ages.[40] For example, a large study in the U.S. found that, until age 60, impaired visual acuity was due to uncorrected refractive errors in 85–90% of individuals while, after age 60, at least 40% of impairment was caused by ocular disease.[41] Glaucoma can cause vision loss (mainly from visual field loss) and diabetic retinopathy can cause impaired visual acuity, but screening for these conditions is not the focus of this review on screening in primary care settings. Glaucoma screening requires equipment (e.g., for visual field testing and viewing the optic nerve) and expertise only infrequently available in a primary care setting, and testing for diabetic retinopathy is considered case finding (rather than screening) by specialist practitioners within a group of people with a high risk of acquiring the condition.

Refractive Errors. Refractive errors comprise myopia (nearsightedness), hyperopia (farsightedness), astigmatism (difference in refractive error between two meridia), and presbyopia. They occur when the eye is unable to focus light on the fovea. Presbyopia, which occurs due to the eye's natural aging (e.g., loss of flexibility in the lens at about age 45), is the loss of the eye's ability to change its focus to see near objects. Impaired visual acuity may exist with or without refractive correction; for the purposes of this report we focus on presenting, or habitual, visual acuity and not best-corrected. Refractive errors can be treated with spectacles,

contact lenses, or reading glasses. Refractive errors may also be corrected with refractive surgery (e.g. laser in situ keratomileusis [LASIK] or epithelial keratomileusis [LASEK]), although this option is more often selected in younger adults.[42] Rates of complications are generally low; a review found corneal ectasia rates ranging from 0 to 0.87% for LASIK and keratitis rates from 0 to 3.4% for LASIK and LASEK.[43] Improvement in vision-related QoL of older persons has been demonstrated when uncorrected refractive error is corrected.[44,45] Both refractive lenses and surgery are considered effective for correcting refractive errors and improving vision-related function in older adults with little harm.[43] For some, though, impaired visual acuity may be too severe for adequate correction.

Age-Related Macular Degeneration (AMD). Age-related macular degeneration (AMD) is the most common cause of legal blindness in individuals over the age of 65 in North America.[40] It has been estimated that AMD causes about 50% of all cases of blindness in old age in developed countries.[46] AMD affects the central part of the retina—the macula, leading to progressive loss of central vision (i.e., blurring vision) and, if severe, to scotomas (complete loss of central vision). Macular degeneration can be "dry" (deterioration and loss of photoreceptors without new blood vessel formation) or "wet" (presence of blood vessels that leak); wet AMD is less common but results in faster vision loss. Antioxidants and zinc are effective for managing dry AMD; they have been shown (10-year follow-up of the Age Related Eye Disease Studies [AREDS]) to reduce conversion of dry to wet AMD (OR, 0.66; 95% CI, 0.53 to 0.83) and moderate vision loss (OR, 0.71; 95% CI, 0.57 to 0.88),[47,48] without association with increased risk of most adverse events.[43] Treatments available for wet AMD include thermal laser, photodynamic therapy, and antiangiogenic (anti-VEGF) drugs administered into the vitreous cavity.[49] Today anti-VEGF therapy dominates treatment for wet AMD. Studies between VEGF inhibitors and sham have reported no significant differences in incidence of serious ocular harms, including ocular hemorrhage, retinal detachment, or endophthalmitis, although results across studies were found to be imprecise in one review because of low event rates.[43] There is some high quality evidence that some anti-VEGF agents injected into the vitreous may increase systemic vaso-occlusive events though the number needed to harm is very high. Tobacco smoking is the principal modifiable risk factor for development and progression of AMD,[50-53] such that smoking cessation interventions are speculated, but not proven, to offer considerable benefit. Another modifiable risk factor is sun exposure (≥ 8 hours daily) during working years.[54] For both dry and wet AMD, aims are early identification and prevention of progression and permanent vision loss;

rehabilitation strategies are also available to reduce associated harms (see Additional Therapy and Services below).

Cataracts. Cataract occurs when denaturation of lens proteins in aging eyes cause the normally transparent lens to opacify, leading to blurring of vision, increased sensitivity to glare, and loss of contrast sensitivity. Cataracts represent the second most common cause of correctable impaired visual acuity after the correction of refractive error.[34,55] Worldwide, cataracts are the most common cause of blindness. Advancing age remains the most common risk factor, with progression typically extending over a long period of time. Other common risk factors include diabetes mellitus, smoking, alcohol, history of ocular trauma, ultraviolet light, and previous intraocular inflammation or surgery (e.g., for glaucoma).[56,57] The most common treatment is surgical cataract extraction and intraocular lens implantation. Phacoemulsification, involving ultrasound energy with small corneal incisions and soft artificial lens insertion, is the most commonly used method for removing the lens in developed countries.[58,59] Based on a large number of observational studies and widespread clinical consensus, cataract surgery is believed to be highly effective in improving visual acuity with a low complication rate (e.g., 0.13 percent endophthalmitis), in patients with mild to advanced cataracts.[43] Cataract surgery is the most common surgical procedure performed in health services in high income countries, leading to great public health implications.

Additional Therapy and Services

Vision Rehabilitation Therapy and Treatment. When other treatments do not adequately correct impaired visual acuity or improve vision-related function, are contraindicated or otherwise not used, vision rehabilitation therapy and treatment should be considered.[17,60] This can include training (e.g., eccentric viewing in AMD) and/or devices to improve vision-related tasks such as reading and mobility. Home modifications may be undertaken to improve visibility using contrast and lighting modifications. Optical devices are also often used, including optical magnifiers and video magnifiers. These services can include multidisciplinary assessment and training by optometrists, ophthalmologists, and others including social workers, occupational therapists, and orientation and mobility professionals; multidisciplinary clinics are located in some Canadian provinces including Ontario (n=10), Quebec (n=14), Alberta (n=2), and Manitoba (n=2), but in others, optometrists work independently to provide assessment and devices, with referral to the Canadian National Institute for the Blind (CNIB) for other aspects of rehabilitation.[17] There is also heterogeneity in the availability and extent of government funding

for these services. A model has been proposed recently for integrated low-vision rehabilitation services in Canada.[17]

Organizations Serving People with Impaired Visual Function and Blindness. In Canada, the largest agency serving people with impaired visual acuity and blindness is CNIB which has nine geographic service divisions and over 60 regional offices; there is also a CNIB Library for the Blind which serves all areas of Canada. CNIB operates a variety of rehabilitative, low-vision and social service programs, as well as prevention of blindness and public education programs. Several other organizations exist within the country to provide services, with a few examples being the Canadian Council of the Blind (an organization of consumers), the *Institut Nazareth et Louis-Braille* (the largest provider in Quebec), and MAB-Mackay.

***Social Programs*.** Other supports exist for people with severe vision loss that meets certain criteria. According to the Canadian Ophthalmologic Society[40] "identification can lead to access to financial resources, through disability pensions or social programs geared to the visually impaired, that may enhance quality of life despite poor visual status." Although the national disability pension benefit program (Canadian Pension Plan Disability Benefits) is only offered to those under 65, disability tax credits and savings plans are available and provincial social assistance and support programs exist (e.g., Alberta's Cross Disability Support Services and Adult Health Benefit Program, British Columbia's Disability Assistance Program, the Ontario Disability Support Program, PEI's Disability Support Program). In view of the possible impact of vision-related functional impairment on social roles and relationships, some Canadian experts have called for the creation of more community and other targeted interventions for allowing people to maintain active social participation.[14]

Screening Tests in Primary Care

Screening for impaired visual acuity or vision-related functional limitations in primary care does not imply replication of the comprehensive eye examinations used in offices of eye professionals. Although eye professional organizations consider a comprehensive eye examination a form of screening (in terms of primary prevention in asymptomatic people),[40] such an examination within this review would be considered diagnostic in nature and would not be feasibly conducted in primary care. The intent of screening in primary care would be to use one or more simple tests (with sufficient accuracy) to attempt to identify individuals with impaired visual acuity or other problems causing functional limitations, but who have not sought eye assessments or care themselves, for referral to, or care coordination with, eye or other

professionals. Screening tests that would likely be feasible for application by a primary care provider without specialized equipment or extra training can be categorized into three groups: direct tests of near or far visual function (e.g., acuity tests with reading or describing text or symbols on charts or pages), direct clinical examination of the eye and its structures (e.g., fundoscopy), and structured enquiry about visual acuity or vision-related functional limitations/problems. Screening tests may be used alone, or in combination with other tests evaluated within multicomponent assessment strategies (e.g., comprehensive geriatric assessments). As such, screening may be situated within prevention programs or interventions.

Eye Function Screening Tests. Most tests of eye function used in primary care practice will focus on testing visual acuity. The Snellen chart (widely used in primary care) assesses high contrast distance visual acuity, using letters of different sizes arranged from largest at the top to smallest at the bottom, read one eye at a time or with both eyes usually from 6 meters (20 feet). A person with 20/100 vision would need to be 20 feet away to read the smallest letters that someone with "normal" (20/20) vision could read at 100 feet. The fraction can also be given using the metric system (6/6 in meters = 20/20 in feet; 6/12 = 20/40, and 6/18 = 20/60) or using the decimal or the logarithm of the minimum angle of resolution (logMAR) conversion. In logMAR units, lower scores represent better vision. A more standardized test available and considered the gold standard for clinical trials is the ETDRS chart.[61] The frequency of its use in primary care in Canada is not known but it appears to be feasible and practical for this setting. This chart has letters with equal legibility, rows with an equal number of letters, a true log progression in letter sizes down the chart, and consistent spacing between letters and rows (i.e., controlled crowding). This and other "logMAR" charts were developed to improve accuracy and repeatability, thus improving accuracy of longitudinal follow-up measurements. For example, the test-retest reliability of the ETDRS charts (about ±0.10 to 0.15 logMAR [1 to 1.5 lines] in normal vision)[62-65] has been shown to be significantly better than with Snellen charts (up to ±0.33 logMAR[66]). The variability of both charts increases in poor vision situations,[67-69] and may be higher in typical use than in research settings.[62] For statistical analysis, acuity scores from any chart can be converted into logMAR units for comparison, although this is not very meaningful with the older Snellen charts.

Other Tests. Other visual acuity testing can also be assessed using a handheld card or other screening tools; a common threshold of reduced visual acuity is an inability to read a newspaper at a normal reading distance of 40 cm with best refractive correction.[70] Tools exist (e.g.,

Tumbling Es, Landolt C, Lea test) that incorporate symbols/optotypes that do not require familiarity with the Roman alphabet. Pinhole testing may detect some, but not all, cases where refractive correction may improve visual acuity; it will not correct reduced acuity due to non-refractive causes such as cataract or AMD. Pinhole acuity therefore has value in distinguishing between decreased vision from refractive errors and from medical eye problems. Low or mixed contrast sensitivity cards or charts, such as the Pelli-Robinson Contrast Sensitivity Chart,[71] Smith Kettlewell Institute Low Luminance (SKILL card),[72] and Mixed Contrast Reading Card[73] are not widely used yet. The Amsler grid, evenly spaced horizontal and vertical lines on paper, is used to detect retinal defects affecting central vision, including AMD (associated with distortion in the boxes on the grid or blank areas in the grid), although its sensitivity and specificity have been reported as poor.[74]

Clinical Examination of Eye and Its Structures. Clinically significant cataracts can be visualized via physical examination as change of colour or opacities in the lens. Early signs of retinal defects can be observed using fundoscopic examination. This testing for the most part is considered to apply within comprehensive eye examination by eye professionals.

Vision-Related Functional Limitations. Because vision-related function does not correlate highly with visual acuity, and vice versa, it may be useful to assess patients' perception of the effect of their vision (and any interventions) on their functional ability.[75] Structured screening questions may be used (administered by personnel or patients) to elicit perceived problems in function (e.g., reading, driving) due to vision, but not specific to visual acuity. Questions may be used alone or within an interview schedule or assessment of various health domains (e.g., comprehensive geriatric assessment). Use of a validated questionnaire such as the National Eye Institute Visual Function Questionnaire (NEI-VFQ-25) may also allow interpretation on their vision-related quality-of-life.[76,77]

Rationale for Review of Vision Screening in Primary Care

Although regular eye examinations for older adults (≥65 years of age) within professional vision settings (e.g., optometrist offices, ophthalmologist offices) are promoted, readily available (over 4,500 optometrists in Canada), and widely-funded in Canada, it is unclear whether primary care professionals should routinely screen for impaired visual acuity or other vision problems in this population. Decisions on whether or not to recommend screening in primary care depend on the

degree to which identifying problems in this setting leads eventually to benefits that would not otherwise be achieved, and that any benefits achieved would be sufficient to justify any harms. Such benefits would include improvements, or prevention of decline, in visual acuity and/or vision-related functioning, and reductions in potential consequences of poor vision such as fractures or loss of independence. One factor that may influence whether primary care screening would be effective is the degree to which most older adults are routinely visiting eye care professionals (regardless of whether they have symptoms), or if there is a significant number not seeking this care who therefore may have unrecognized vision problems and may benefit from screening in primary care.

Self-reported data by seniors in the Canadian Community Health Surveys in 2005 suggested that 59% consulted with optometrists or ophthalmologists (in-person or via the telephone) during the previous year.[78] The survey also found that 86% of those with glaucoma, 76% of those with cataract, and 63% of those with diabetes had used an eye care provider in the last year. Despite these data, it is unclear what proportion of people who are not seeking eye professional care—because of complexities related to symptoms (e.g., vision changes can be relatively subtle, progress slowly over time, or occur in persons with cognitive dysfunction or other comorbid conditions) or other barriers to care such as geography or lack of access to resources—would benefit from either doing so, or receiving screening in primary care. Relatively high attendance at eye professional offices by older adults within Canada might be expected due to the widely available public funding for periodic eye examinations for this demographic; beyond assessment, though, funding for spectacles, low vision services, and equipment is quite variable.[17,78,79] Moreover, findings that over 40% of older adults in Canada have not sought a vision assessment over the previous year[78] and that between 11-51% of older adults in developed countries have undetected, but highly correctable, impaired visual acuity (<20/40; based on pinhole correction) suggest that there could be benefit from primary care screening.[30]

Relevant Guidelines

There exist no Canadian recommendations on vision screening for adults at or above 65 years of age targeting primary health care providers apart from eye professionals.

Primary Care Physician Settings

The United States Preventive Services Task Force (USPSTF) has, to-date, offered the most relevant guideline in terms of targeting primary care providers (not eye professionals), on visual acuity screening in primary care for adults 65 years and older and not presenting with vision problems.[80] Their 2016 recommendation was "no recommendation" because of "insufficient evidence to assess the balance of benefits and harms of screening for impaired visual acuity in older adults." Of note, the most direct evidence on screening program effectiveness used for this guideline was from three trials undertaken mainly in primary care physician offices. Evidence from screening in homes or other primary-healthcare-relevant settings was not examined.[43]

The American Academy of Family Physicians recommendation on screening for visual acuity in older adults is in agreement with this USPSTF recommendation (insufficient evidence).[81]

In 1995, the Canadian Task Force on the Periodic Health Exam, the earlier iteration of the CTFPHC, recommended performing visual acuity testing using the Snellen chart and fundoscopy or retinal photography as part of periodic health examination of elderly patients with diagnosis with diabetes for at least 5 years (B recommendation).[82] No recommendation was made for the general population 65 years of age or older.

Eye Professional Organizations

Most guidelines for vision screening are developed within the context of eye professional settings; the term "screening" in such guidelines refers to asymptomatic patients but usually involves tests which go well beyond what is possible in primary care. Because of this, the below guidelines are acknowledged although are not directly related to this review focusing on vision screening by other primary care providers using simple screening tests.

The Canadian Ophthalmological Society's 2007 recommendations on periodic eye examinations (i.e., by an eye professional) specify comprehensive eye tests for: (i) asymptomatic, low-risk older adults (>65 years) at least every two years (Level 1 evidence), (ii) high-risk (e.g., those with diabetes, cataract, macular degeneration, or glaucoma [and glaucoma suspects], and patients with a family history of these conditions) adults over 60 annually (Consensus), and (iii)

symptomatic adults of all ages noting changes in visual acuity, visual field, colour vision, or physical changes to the eye as soon as possible (Consensus).[40]

The Canadian Association of Optometrists recommends adults aged 65 years or older should undergo an eye examination annually (Level 1 evidence using 2001 USPSTF criteria).[83,84]

The American Academy of Ophthalmology recommends comprehensive medical eye examinations (i.e., by an optometrist or ophthalmologist) every 1-2 years for asymptomatic patients 65 years and older without risk factors; recommendations for those with risk factors are limited to glaucoma.[85]

The American Optometric Association recommends comprehensive adult eye and vision examinations annually for those over 60 and asymptomatic or risk free, and annually or as recommended for those over 60 and at risk.[86]

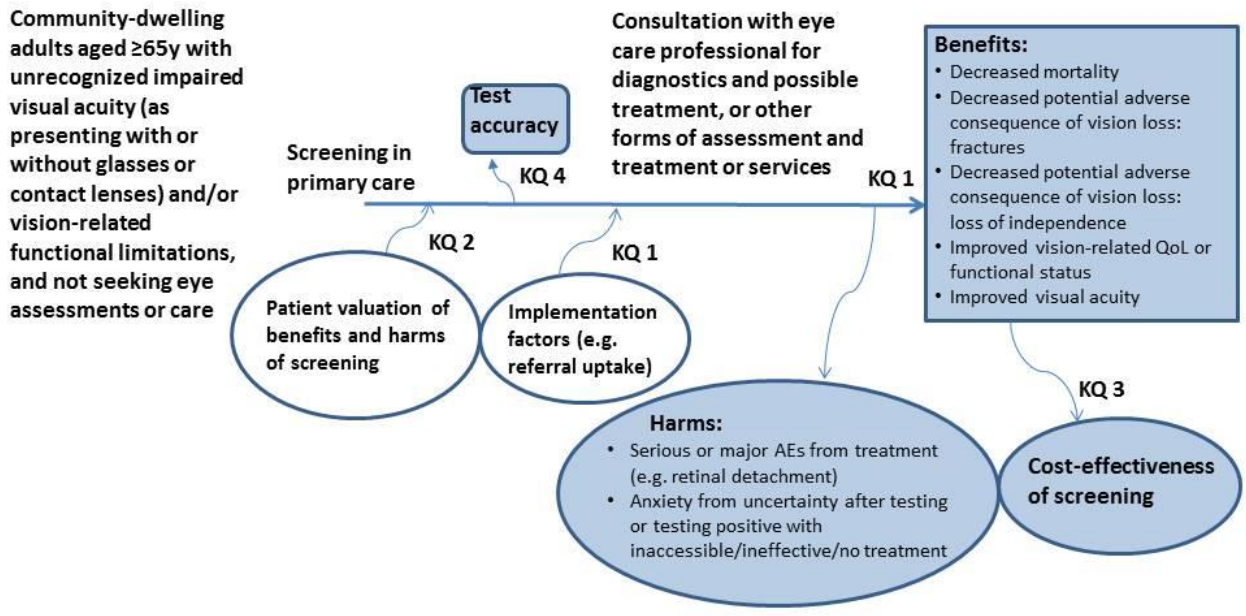
Section II. Review Scope and Approach

This review was completed by the Evidence Review and Synthesis Centre (ERSC) at the University of Alberta. The review was developed, conducted, and prepared according to the CTFPHC methods (http://canadiantaskforce.ca/methods/methods-manual/). A working group of CTFPHC members was formed for development of the topic, refinement of the key questions and scope, and rating of patient-important outcomes considered most important for creating a recommendation. Perspectives of patients, and members of the public were incorporated regarding prioritization of outcomes (benefits and harms), and will be engaged once again during guideline development. The protocol was registered with the International Prospective Registry of Systematic Reviews (PROSPERO) database (CRD42016053088).

Analytical Framework

Figure 1 is an analytical framework that depicts the structure used to address the relevant Key Questions (KQs) for evaluating the benefits and harms of primary care screening for community-dwelling older adults (≥ 65 years) with unrecognized impaired visual acuity or vision-related functional limitations.

Figure 1. Analytical framework



AE = adverse effect; KQ = key question; QoL = quality of life

Key Questions*

Stage 1a

KQ1: What are the benefits and harms of screening compared with no screening for unrecognized** impaired visual acuity or vision-related functional limitations in community-dwelling adults ≥65 years of age?

Stage 1b

KQ2: (a) How do community-dwelling adults ≥65 years of age weigh the benefits and harms of screening for impaired visual acuity or vision-related functional limitations, and (b) how do these values inform their acceptance or decisions to undergo screening?

KQ3: What is the cost-effectiveness of screening for unrecognized impaired visual acuity or vision-related functional limitations in community-dwelling adults ≥65 years of age?

Stage 2

KQ4: What is the accuracy of screening tests commonly used in primary care settings for impaired visual acuity or vision-related functional limitations?

*Decision process for staging outlined in section on Staged Approach, e.g., stage 2 was sequential to stage 1 and would have only been conducted if inadequate quality of the evidence was identified from stage 1a. Stage 1b was not conducted because of little uncertainty by the CTFPHC in the balanace of benefits/harms (KQ2) and lack of effectiveness (KQ3).

**By unrecognized we include people that may have symptoms but have not brought them to medical attention, or do not recognize they have a vision-related dysfunction; they will typically not have actively sought eye assessment or care.

Staged Approach

We took a staged approach to this review based on the quality of the body of evidence for each KQ, assessed using methods developed by the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group (http://www.gradeworkinggroup.org/). The GRADE methods for assessing the quality of evidence (classified as high, moderate, low, very low) are described in more depth later, but, essentially, for each outcome rated as critical by the CTFPHC and sample of patients, a rating of high quality evidence relies on precise and consistent effect estimates from studies having few limitations on internal validity (i.e., not high risk of bias) and examining directly relevant populations, interventions, comparators, and

outcomes (i.e., PICOs). Decisions made during the evidence review (to proceed through KQs) are based on the information needs of the CTFPHC for making a recommendation based on the balance of critical benefits and harms, as defined by transparent rating processes.

Evidence with the potential to provide the most internal validity and direct evidence for the effectiveness of screening programs was prioritized; that is, we started by examining evidence from randomized controlled trials (RCTs) of screening programs reporting on clinically important outcomes (most directly related to PICOs and analytical framework) for KQ1. These studies would compare outcomes over time between a control group of no screening/usual care, and an intervention group for which there is an intent to screen all people and, if indicated, encourage them through referrals or otherwise to seek further assessment by eye professionals and possibly treatment or other services to improve their vision and/or other patient-important outcomes related to vision. Further staging beyond this point (observational evidence for KQ1 or review of KQ4) would require careful deliberation with documentation of rationale. In cases where evidence on test accuracy and treatment effects may be used to provide indirect evidence on screening program effectiveness, limitations would be recognized that this evidence may not account for several factors (e.g., differences in absolute, and possibly relative, effects when comparing studies in general screening populations vs. those requiring treatment; follow-up on referrals for diagnosis and/or treatment; adherence to screening and treatment; types of screening protocols) that would be captured by direct evidence. Only the study designs with the highest possibility of internal validity (RCTs for treatment and exclusion of case-controls for accuracy) would be examined. Answering KQ 2 is important when the evidence suggests that an intervention may be effective or that there may be important harms, but there is some degree of uncertainty, or when there is evidence of effectiveness, but there are also important harms to consider and the balance between these could reflect personal preferences. Examining cost-effectiveness (KQ3) relies on having enough moderate-to-high quality evidence on KQ1 with demonstration of a positive benefit-harm ratio. We report here only on KQ1 because the CTFPHC determined that at this time examination of the other KQs was not required for their decision making.

Section III. Review Methods

Integration of Existing Systematic Reviews

To build in efficiencies and capitalize on other work conducted, we followed, as suitable, the CTFPHC's approach to integrating existing systematic reviews (see **Appendix A**). For this review, our approach focused on examining existing reviews to identify studies meeting our criteria, with the addition of an update of the evidence to present date using a unique, comprehensive search. We had no plans to use data extraction or other findings from the reviews. During protocol development, we identified four good quality systematic reviews to integrate into this review; reviewing their searches, scope, inclusion criteria and included/excluded studies lists indicated they would together capture studies for KQ1 to 2012 and KQ4 to 2015.[43,87-89] Additonal systematic reviews identified during our search update from 2012 were also examined closely for studies.

Literature Search

For KQ1, we conducted searches to update the literature from that identified by existing reviews to 2012. Our planned searches for KQs 2-4 are included in our protocol (available at http://canadiantaskforce.ca/guidelines/upcoming-guidelines/visual-acuity/) but not here because of the focus on KQ1.

The literature search strategy for KQ1 was developed and implemented by a research librarian. The search strategy consisted of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords, and was peer-reviewed using the PRESS checklist. Terms used were intended to generate a highly sensitive search to capture studies that may employ vision screening as a (even unreported) portion of a multicomponent assessment (e.g., geriatric assessment, risk assessment) as well as interventions to reduce risk for older adults. Methodological filters were applied to limit retrieval to RCTs. The search was restricted by language to include full texts published in English or French, and was limited to a publication date on or after 2012.

On August 30, 2016, we searched MEDLINE (1946-) via Ovid; Embase (1974-) via Ovid; Cochrane Library; CINAHL (1937-present) via EBSCOhost; and PubMed via NCBI Entrez. The searches were updated in October 2017. The search strategies for all databases are reported in **Appendix B**.

Supplementary searches were conducted and documented according to CTFPHC methods for grey literature searching, primarily through internet-based searches (via adapted Canadian Agency for Drugs and Therapeutics in Health [CADTH] grey literature checklists; https://www.cadth.ca/resources/finding-evidence/grey-matters) and trial registries (ClinicalTrials.gov, World Health Organization International Clinical Trials Registry Platform). Websites of relevant Canadian stakeholder organizations were also searched. We reviewed the bibliographies of all included papers and relevant systematic reviews. We contacted authors (by email with three attempts over 30 days) of relevant protocols, trial registries, and abstracts that identified studies not located in the searches to obtain any reports or publications of completed studies.

All results of the database searches were imported into an EndNote® database (Thomson Reuters, New York, NY) for reference citation, and into DistillerSR (Evidence Partners Inc., Ottawa, Canada) for screening and selection procedures. Our grey literature search process was documented, with literature eligible for full text screening identified in the PRISMA flow diagram.

Eligibility Criteria

Table 1 outlines the study eligibility criteria for KQ1 based on the population, intervention, comparator, outcomes, timing, setting, and study design (PICOTS-D). Following the table, we provide details on outcome rating and additional criteria. For this review, the term *unrecognized* was used to represent people who may have symptoms but have not brought them to medical attention, or who do not recognize they have a vision-related dysfunction; they are people who have not recently sought eye assessment or care. Trials including younger participants were included if the mean age minus one standard deviation (SD) was more than 65 years.

Table 1. Eligibility criteria using PICOTS-D for KQ1: Benefits and harms of vision screening

Criteria	Include	Exclude

Populations	Community-dwelling adults age 65 years and older with unrecognized* impaired visual acuity or vision-related functional limitations ***Population subgroups of interest*:** age (65-74 vs 75-84 vs 85+), socioeconomic status (i.e., education, income), ethnicity (i.e., percent non-Hispanic white versus others), geographical region (rural vs. urban)	Significant portion of participants (>25%) with visual acuity worse than 20/200 (i.e. severe or profound visual impairment) Focus on older adults having characteristics placing them at high risk for vision problems or when screening test application by primary care providers would be considered significantly challenging. This would exclude studies where most patients have a history of falls, residency in nursing homes, diabetes, dementia (including Alzheimer's), other disorders of the vision system such as glaucoma as well as stroke, Parkinson's or other conditions making it difficult to participate in vision screening.
Interventions	Vision screening tests, alone or within multicomponent screening/assessment, performed by primary health care professionals (may include home- or online-based tools interpreted by primary care professionals) or their designates Screening may be followed by interventions including referral and structured treatment or therapy provided by eye care professionals, occupational therapists, or social workers for screen positive participants in intervention arm. ***Intervention subgroups***: type of screening test (i.e. self-report vs. charts or other more objective tests; visual acuity vs. vision-related function), active treatment vs. referrals vs. no referrals; health care provider interpreting the tests (physician vs nurse vs other); setting of program (physician office vs. community/home)	Tests or assessments that only evaluate reading speed or visual field Tests performed by eye professionals
Comparator	No vision screening, delayed screening, attention control (e.g. educational session without tests), screening/assessments involving all components as intervention except vision component; usual care (may include targeted screening/case finding)	Different vision screening test
Outcomes	<u>Benefits</u>: • Mortality	When vision screening is within a multicomponent screening intervention, the study will only be included

	• Potential adverse consequence of poor vision: fractures (risk or rate of incidence; will accept falls as surrogate) • Potential consequence of poor vision: loss of independence • Vision-related QoL or functioning: (i) using composite/index scores from validated scales (e.g., Activities of Daily Vision, National Eye Institute Visual Function Questionnaire, Visual Function Index) (ii) non-validated tools involving self-report of functional limitations related to vision (e.g., reading, IADLs) • Presenting (habitual with or without glasses) visual acuity: (i) mean change in acuity in logMAR units (ii) proportion with minimally important difference, i.e., change of 0.10 logMAR (5 letters, 1 line) (iii) proportion at follow up with acuity equal to or better than 6/18, 3/10 (0.3), 20/60, logMAR 0.5 (i.e., no or mild impairment using WHO classification) (iv) proportion at follow up with acuity equal to or better than 6/12, logMAR 0.3, 20/40 (i.e., impaired visual acuity using North American convention) (v) self-report of visual disturbances (e.g., blurred vision) <u>Harms</u> • Serious or major AEs from associated vision/eye treatment (requiring hospital admission, urgent intervention, causing disability, permanently limiting self-care or activities of daily living or as defined by authors) • Anxiety or stress if true positive/diagnosed but treatment options are limited or inaccessible (e.g., because of real or perceived costs) for condition (e.g., AMD, contraindications) <u>Implementation Factors**</u>	in assessment of vision-related outcomes, i.e. not for mortality, falls etc., unless the outcome is attributed directly to a reduced or improved vision by the authors.

	• Uptake of referrals (proportion of intervention group) • Eye care professional visits (difference between groups)	
Timing	1980 to present (approximate onset of policy and research on vision screening in primary care) Any follow-up duration ***Subgroups***: short-term (0-<6 months), medium-term (6-<24 months), long-term (24+ months) follow-up	
Design	Health outcomes & implementation factors: RCTs only Harms: staged to RCTs, then controlled experimental, then controlled observational	
Language	English and French	
Setting	Generalizable to primary health care, including but not limited to physician offices, primary care clinics, community health centres, participant's home, prisons, remote stations	Eye specialist setting Any setting where it could not be reasonably generalizable to a Canadian primary care

***** By unrecognized we include people that may have symptoms but have not brought them to medical attention, or do not recognize they have a vision-related dysfunction; they will typically not have actively sought eye assessment or care.
**Secondary outcome in studies reporting on other outcomes.

Outcome Rating

The primary outcomes of interest for this review are listed in Table 1. The outcomes considered most patient-important, thus critical for making recommendations on screening for impaired visual acuity and vision-related functional limitations were selected based on ratings by members of the CTFPHC and on the basis of the findings of an engagement exercise with a sample of older adults in Canada, conducted by an independent group with expertise in knowledge translation from St. Michael's Hospital in Toronto, Ontario. All patient-important outcomes rated as critical (7 to 9 out of 9) were included, with the possibility to also include those rated as important (4 to 6 out of 9) if there were fewer than eight critical outcomes; this rule of thumb for the number of outcomes is based on guidance based on cognitive limits when guideline panels are considering net balance of benefits and harms. Outcomes in the category of Implementation

Factors were considered secondary outcomes, therefore were only considered when studies also reported on one or more critical outcomes. All outcome ratings were conducted prior to final study selection and data extraction; that is, the CTFPHC was blinded to the studies and their results.

Additional Eligibility Considerations

We did not have a minimum sample size for inclusion, nor did we have a minimum threshold for extent of incomplete follow-up or participant attrition; these factors were considered during assessment of the quality of the body of evidence (e.g., using GRADE methods the precision domain accounts for sample size across studies and the study limitations/risk of bias domain considers high and/or differential attrition).

Case reports and case series (i.e., group of patients selected based on particular outcome) were excluded as were papers not reporting primary research (e.g. editorials, commentaries, opinion pieces). Conference abstracts and systematic reviews were not eligible for inclusion, but were examined and served to help identify full study reports.

Screening and Selecting Studies for Inclusion

For the database searches, two reviewers independently screened the titles and abstracts (when available) using broad inclusion/exclusion criteria. Citations were classified as “include/unsure,” “exclude,” or “reference” (i.e., conference abstracts, protocols, and systematic reviews). One reviewer examined the “reference” group further, and this reviewer and the librarian conducted all grey literature searches. The full text of all studies classified as “include/unsure” or identified after reviewing the reference citations or grey literature were independently reviewed by two reviewers using a standard form outlining the inclusion and exclusion criteria. Disagreements on final inclusion of all studies were resolved through consensus or consultation with a third reviewer. The title/abstract screening and full-text selection processes were conducted and documented in DistillerSR. The flow of literature and reasons for full text exclusions were recorded in a PRISMA Flow Chart.

At any stage of screening, we screened as “include/unsure” studies evaluating multicomponent screening or assessments, where it was not clear if a vision test was incorporated and/or if vision

outcomes were collected or analyzed. For this to occur in cases of missing test information at full text review, there must have been enough description of the screening/assessment to suggest a vision component may have been included (e.g., mention of physical or medical function, or safety/risk assessment), or mention of referral to a range of specialists. Studies with a clear focus on one or more interventions (e.g., exercise therapy, cognitive therapy) unrelated to vision were excluded. For those we screened in with insufficient data for inclusion/exclusion, we contacted the first or corresponding author by email (via published report or limited internet searching), up to three times over four weeks to obtain further clarification on the intervention and/or whether data for vision outcomes were available. We accepted individual patient data (raw data) on outcomes provided it was delivered in an easily accessible and analyzable format.

Data Extraction & Reporting

One reviewer independently extracted data from each included study; a second reviewer verified all data. Disagreements were resolved through discussion or consultation with a third reviewer until consensus was reached.

Study characteristics tables were created for each study and a narrative summary was written to summarize all studies by design, country of origin, sample sizes, population(s) (including subgroups), intervention(s) (including data on screening criteria and for subgroup questions), comparator(s), setting, and outcome measures, as reported by studies.

When there were multiple publications associated with a study we considered the earliest report of the main (primary) outcome data to be the primary data source, so long as this was a full paper and not an abstract. We extracted data from the primary source first and then added outcome data reported in the secondary/associated publications and data sources. We reference the primary source throughout the evidence report; where applicable we also cite an associated publication.

For continuous outcomes measures, we extracted (by study arm) the mean baseline and endpoint or change scores, standard deviations (SD) or other measure of variability, and number analyzed. We did not include outcome data from studies that did not provide a follow up change or endpoint scores, or data that could be used to calculate follow up scores. When necessary, we

approximated means by medians. If standard deviations were not given, they were computed from p-values, 95% confidence intervals (95% CIs), standard errors, z-statistics, or t-statistics. If computation was not possible they were estimated from upper bound p-values, ranges, inter-quartile ranges, or (as a last resort) by imputation using the largest reported SD from the other studies in the same meta-analysis. For dichotomous outcomes, we extracted counts or proportions, and sample size, by study arm. Details on our methods for extracting data for harms are included in our protocol but were not used in this review which included no studies reporting on the harms of interest.

Data on within-study analyses on our subgroups of interest was collected, including: subgroups (independent variables), the type of analysis (e.g., subgroup/stratified or regression analysis), the outcomes assessed (dependent variables), and the authors' conclusions. We collected data suitable for patient and intervention subgroups (see Table 1) for performing our own subgroup analyses based on study-level data.

Units of Analysis Issues. Unit of analysis errors can occur in studies that employ a cluster design (i.e., a clinical practice) and yet are analyzed at the individual level (i.e., patients), potentially leading to overly precise results and contributing greater weight in a meta-analysis. For trials which were cluster-randomized, for example by medical practice but not individual homes, we performed adjustments for clustering if this was not done in the published report. We used an intra-class correlation coefficient (ICC) of 0.01 reported in Smeeth 2002.[90]

Risk of Bias Assessment

Two reviewers independently assessed the risk of bias (ROB) of each included study, with disagreements resolved through discussion to reach consensus. The results for each study and across studies are reported by each domain and for the overall ROB score. The ROB for each study was assessed on an outcome basis where needed, particularly when different outcomes were assumed to have different susceptibilities to bias; for example, subjective outcomes and

expected harms are more prone to bias from non-blinding than objective outcomes and unexpected/rare harms.

The RCTs were appraised using the Cochrane Risk of Bias tool.[86] This tool consists of six domains (sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and "other" sources of bias) and a categorization of the overall ROB. For each domain a rating of low, unclear, or high ROB is determined. Blinding and incomplete outcome data were assessed separately for patients/providers and outcome assessment, and also by outcome (e.g., subjective vs. objective). To assist with outcome reporting bias assessments, we sought study protocols and studies/data from registries; our contact with authors to obtain outcome data also helped to minimize this bias. The overall assessment was based on the responses to individual domains. If one or more individual domains were assessed as having a high ROB, the overall score was rated as high ROB. The overall ROB was low only if all components are rated as having a low ROB, and was unclear for all other studies.

Data Analysis & Synthesis

For pairwise meta-analysis, we employed a random effects model using Review Manager Version 5.0 (The Cochrane Collaboration, Copenhagen, Denmark). For continuous outcomes, we report a pooled mean difference (MD); if multiple tools were used we would have used one of a variety of options that exist for communicating results when combining two or more outcome scales measuring similar constructs (based on clinical input).[91,92] For dichotomous outcomes, we reported relative risks (RR) or rate ratios, and absolute effects between groups with corresponding 95% CIs. For calculating the absolute effects, we used the relative risk and median baseline risk for the control group in the included studies. If event rates were less than 1%, the Peto odds ratio method was planned, unless control groups were of unequal sizes or when there was a large magnitude of effect; when events became more frequent (5%–10%), the Mantel-Haenszel method without correction factor was used for quantitative synthesis.[93]

The decision to pool studies was not based solely on the statistical heterogeneity (I^2 statistic was reported), but rather on interpretation of the clinical and methodological differences between

studies. When substantial heterogeneity was suspected, we conducted sensitivity analyses for methodological differences, as appropriate (e.g., for studies rated as high risk of bias, parallel versus cross-over designs), or subgroup analysis when heterogeneity was thought to arise from differing effects based on our planned population or intervention subgroups of interest (see Table 1 and section below). Where there were at least eight studies in a meta-analysis, we analyzed small study bias (which includes publication bias) both visually using the funnel plot and quantitatively using Egger's test.[94] We would not have combined results from RCTs with other study designs, if applicable. When a meta-analysis was not appropriate or feasible (based on reporting) the results of each study are described.

Subgroup Analyses

Our primary approach for evaluating differential effect for subgroups (see Table 1) was to record any within-study subgroup analyses performed by study investigators using individual patient data; these results preserve the within-study randomization. Because these results are often based on diverse methodology and may be difficult to interpret across the body of evidence, we also performed our own subgroup analyses using study-level data, as possible, using either meta-regressions (usually for continuous variables to enable some quantification of the effect) or by stratifying the results of the pairwise meta-analyses by categories based on subgroup variables. Stratified analyses were considered when at least two studies made up any group in a meta-analysis (e.g., short vs. medium vs. long duration follow up; mean age for study was 65-74 years vs. ≥75 years of age). Some support for the findings occurs when variables are limited in number and defined a priori, the magnitude of the difference is practically important (supporting different recommendations for each group), and the difference in the effects between subgroups are statistically significant (e.g., Chi^2 test for subgroup effects).[95] Nevertheless, these analyses rely on study-level data and are observational (i.e., studies are not randomized), therefore are interpreted as exploratory.

Assessment of the Overall Quality of the Evidence using GRADE

Two reviewers independently assessed the quality of the body of evidence, or confidence in the effect estimates, for each outcome of interest using the GRADE methodology.[96-100] Discrepancies were resolved through discussion and third-party consultation to reach consensus. Assessments were entered into GRADEPro software and summarized in GRADE Evidence Profiles and Summary of Findings tables. Within the GRADE Evidence to Decision (EtD)

Framework, the CTFPHC will use this evidence on each outcome, to assess the net benefits and harms of each service across all outcomes (considering the relative importance of each), and also consider patient preferences and values in addition to other elements including feasibility, acceptability, costs, and equity (using stakeholder input), to develop the recommendations on screening for impaired visual acuity or vision-related functional limitations in primary care.

The general approach is outlined here although methods align with GRADE guidance. For evidence on the benefits and harms of screening, as a starting point the quality was assigned as high for evidence from RCTs (low if using observational studies). Thereafter, we examined and potentially downgraded the quality based on the five core domains: study limitations/ROB, inconsistency, indirectness, imprecision, and reporting bias. We also considered the additional domains of dose-response association, plausible confounding, and strength of association (i.e., large magnitude of effect [i.e., large ≤ 0.5 or ≥ 2.0 or very large RR ≤ 0.2 or ≥ 5.0]), to potentially upgrade the quality when no other serious concerns existed.[101]

For the *study limitations* domain supported by evidence from RCTs, we downgraded the quality by one or two levels depending on the proportion of trials (e.g., one very large trial may outweigh two very small trials) assessed as having high ROB for the particular outcome under consideration. For *inconsistency* we downgraded when 95% CIs did not overlap each other in most studies; when the body of evidence for an outcome consisted of a single study, although there is no evidence of inconsistency we usually downgrade for this domain because of lack of demonstrated consistency. *Indirectness* of the evidence was based on evaluating the relevance of the body of evidence's PICOs compared with ours; for instance, we downgraded when falls (surrogate to critical outcome) were used for the outcome of fractures. A precise estimate is one that allows for a clinically useful conclusion. We assessed the findings as *imprecise* when the total sample size for the outcome (using total events for dichotomous outcomes) did not meet the Optimal Information Size, or (if OIS sufficient), when the 95% CI crossed no effect but also included values that would represent important benefit or harm to many patients; in terms of these values, for dichotomous outcomes we used a general rule-of-thumb of crossing a RR of 0.75 or 1.25[96] and for continuous outcomes we would use a minimally important difference (MID) for each tool if literature was available for this. We had defined *a priori* MIDs for some continuous outcomes: NEI-VFQ-25 (4-6 point change),[75] and (via clinical input and data on test

reliability) change in visual acuity (≥ 0.1 logMAR = 5 letters = 1 line). Other thresholds would have been determined, as necessary depending on the measurement scale used, based on available literature or clinical input. Thresholds may also be determined by the CTFPHC in a post hoc manner (thus may change the ratings for precision) after considering what magnitude of effect would be clinically meaningful in view of balancing benefits and harms and other considerations such as cost and patient preferences. *Reporting bias* was evaluated with respect to publication (small study) bias.

Interpretations

In efforts to enhance communication about how our interpretations of the quality of evidence reflect varying levels of certainty about the effects, we chose to use standard wording to describe each level of GRADE findings. For findings of high, moderate, low, and very low quality evidence we use "will", "probably/likely", "may/appears to", and "not known/very uncertain", respectively, in our textual descriptions when discussing the results.

Section IV. Results

Key Question 1. Benefits and harms of screening

Literature Search and Selection

Our database searches from 2012 identified 14,995 citations after duplicates were removed; 452 of these were eligible for full text review after screening titles and abstracts. An additional 146 records were eligible for full text review, based on review of all titles and/or abstracts from (i) the included and excluded study lists from the four systematic reviews[43,88,89,102] selected a priori for review (n=138), (ii) other unique records (n=4) from reference lists of 21 other relevant systematic reviews (one on vision[103] and others on geriatric or falls risk assessment etc.) identified in our database search (**Appendix C**), (iii) our grey literature searches of trial registries, dissertation abstracts (n=0), and (iv) stakeholder websites or suggestions during peer review (n=4). After complete full text review (n=452), including author contacts when information was needed for determining eligibility (i.e., inclusion of a vision component to the intervention and vision-related outcomes in cases of multicomponent interventions), we excluded 437 articles for reasons identified in Figure 2 and **Appendix D**, and included 15[104-118] RCTs reporting on 17,400 participants. Fourteen of these were identified by our database search and the four primary systematic reviews; one[118] was found from the reference list of another systematic review.[103]

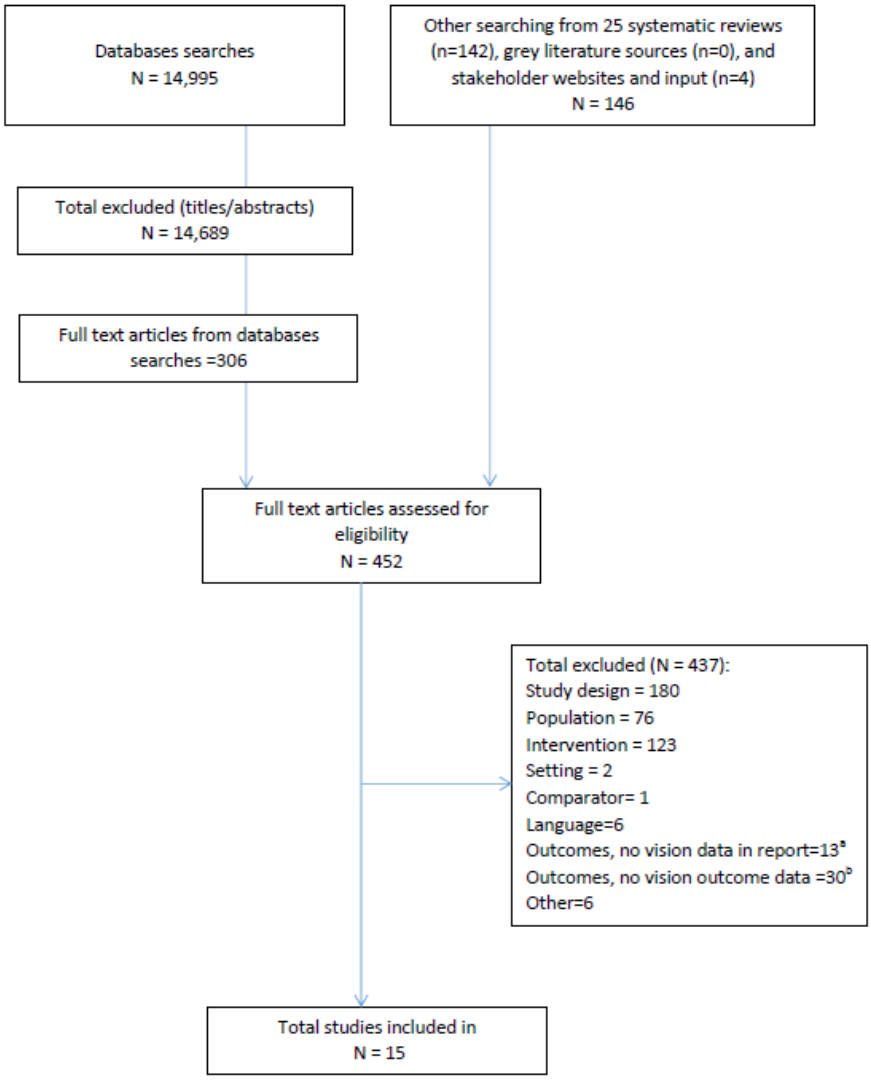
Description of the Included Studies

All 15 trials we included examined older adults regardless of whether or not they had recognized vision problems. Although this deviated from our inclusion criteria, as stated *a priori*, it was decided that while the main population anticipated to potentially benefit from screening in primary care would be those people not having regular eye care provision, in reality screening in primary care would not necessarily use this selective (possibly considered case finding) approach and the benefits at a population level are suitable to examine in terms of screening programs. **Appendix E** includes detailed study characteristics tables.

The number of enrolled participants across the 15 trials ranged from 93 to 4,340. The average age of participants in the 11 trials that reported age was 78.5 years,[104-106,110,112-118] with the other four trials recruiting participants aged 70 and over[109,111], having inclusion criteria of age 75 to

84,[108] or only recruiting participants aged 75 or older[107]. The mean age was below 75 years in three trials,[112,115,116] and 85 years or older in one.[104] A slight majority (62.8%) of participants was female in the 11 trials reporting on sex[104-106,108,111-118] (with one reporting >80% females)[104], two studies reporting on ethnicity included predominately White participants (86.5%)[114,115], and six reporting on the proportion living alone reported that nearly half of participants lived alone (46.8%).[104,106,108,112,113,117]

Figure 2. Flow of literature through screening and selection process



[a] Reports of these trials provided information strongly suggesting no vision outcome data was collected (e.g., only used hospital records) (n=4), or the study authors did not respond to our attempts at contact (n=8).
[b] Authors confirmed that there was no collection of data for an outcome relevant to the vision component of the intervention (n=27; report of another systematic review[89] relied on for 4 of these responses) or that this data was no longer available (n=2).

Only three studies reported on the education level of participants, without any indication that the study population predominantly represented a low or high level of education.[104,112,115] Trials were conducted in Norway,[104] Germany,[112] the U.K.,[106,107,109,111,116] Australia,[110,113,117,118] the Netherlands,[105,108] and the U.S.[114,115] One study noted that 51.5%[109] of participants were from an urban geographical region, another selected from 4 rural and 1 borough municipalities[104]; while others commented that their respondents were from a metropolitan area[112], urban community[113], urban residential area[107], or suburb.[110] Recruitment was from general practice lists for 10 studies;[105-107,109-112,114-116] two trials[108,113] recruited from the population/community, and three from an aged care assessment list,[117] a home care list,[104] or an insurance company registry.[118] Most studies excluded patients living in residential care facilities and/or with dementia, and as per protocol we excluded studies where recent falls or severe cognitive impairment was an inclusion criteria. Only three of the studies required participants to be completely dependent in ADLs,[112,115,116] and in two trials patients were either receiving some form of home care[104] or being assessed for home care provision.[117] For those studies reporting on any falls at baseline (n=7),[106,110,111,113,115,117,118] rates over the previous 12 months were generally 23% to 33%[111,115,117,118] but as high as 55% (receiving aged care assessments),[117] over the last 6 months was 20%,[106] and over the last month was 6.3%.[113] None of the trials exclusively enrolled participants not having regular eye care providers.

Only two[113,117] of the 15 RCTs had an isolated vision screening intervention arm; both trials used a multifactorial design where one or more of four arms did not receive vision screening for comparison. All other trials incorporated vision screening within a multicomponent assessment of health and functioning. Ten [105,107-112,114-116] of the trials relied on self-reports on general presenting vision (e.g., fair or worse vision indicating a positive screen)[108,109,111] or on having one or more difficulties with vision (e.g., reading newspaper or one of several vision-related activities);[105,107,110,112,114-116] in two of these trials,[105,114] participants having responded positively to having difficulties were to also have their vision screened using a Snellen chart. Five trials[104,106,113,117,118] relied only on objective tests of presenting, distance visual acuity, with or without additional tests for other vision functions such as near vision,[117] contrast sensitivity[118] or visual field.[113,117,118] Apart from the Snellen chart screening in those trials also using self-reported vision difficulties, the charts used for measuring distance visual acuity included the Verbaken chart[113] (low and high contrast), Bailey-Lovie logMAR[104], Glasgow acuity chart[106],

VectorVision logMAR chart,[117] and a letter chart with high and low contrast letters reported by the authors.[118,119]

The vision screening was performed at home in seven trials[104,107-111,113], at a physician's office or the home in four,[105,106,112,116] and at a day hospital,[117] falls clinic,[118] physician office,[114] and through telephone calls along with visits to the nurse at a physician office[115] in the other four trials. Screening was performed by nurses in seven of the trials,[104,106-111] by the researchers in two trials,[117,118] a trained assessor[113] or office staff member[114] in two, and through self-reported mailed questionnaires in three.[112,115,116] Only one trial used a physician to complete the screening.[105] Trials reported one screening visit, but also had between 1 and 12 health care interactions after screening where results could have been assessed and treatment referrals made. Follow-up ranged from 2.5 to 47 months (mean 18.6 months); studies with longer follow-up usually had more interactions. All trials included some action based on the screening results, such as providing results to physicians,[110,112,114-116] referrals to eye professionals,[104,108,117,118] one or both of the former.[105-107,109,111,113] For those providing results to the physicians and no direct referrals to eye professionals, three provided physicians with training and manuals and either clinically pertinent articles,[114] or easy access to clinical practice guidelines and screening results within electronic patient records.[112,116] Although it is difficult to predict to what extent other (non-vision specific) features of the multicomponent interventions may theoretically lead to changes in visual acuity or vision-related function, three trials provided co-interventions that were considered more likely to contribute to vision changes beyond what would be expected from referral to eye professionals; these included advice on improving vision (e.g., wearing hats and avoiding multifocal lenses when outside),[118] and home lighting condition improvements.[104,111]

Ten studies reported that the control group also received some form of vision assessment at baseline,[104,106,107,109,111,113-115,117,118] although this information was used for outcome comparison with the screened group and not explicitly acted upon with referrals or other intervention components (i.e., not considered screening). One study using an objective screening method for the intervention group allowed for referrals based on serious self-reported vision problems which were assessed in all people in the control group;[117] another trial of objective screening[106] included "targeted screening" in their control group, with all patients given a basic screen

(including self-reported vision) and those having three or more major health or functional issues receiving a detailed assessment including the objective vision screening (only 5.5% of control group received detailed vision screening). We did not exclude these two studies for not having a comparator of interest (no screening, usual care, or attention control) because there was limited certainty for the other studies that the control group did not receive screening with referrals in some cases (i.e., there was no prohibition from screening/testing control group participants) or that participants' knowledge of their results from the baseline vision assessment would not lead them to self-seek eye professional care. Therefore, we consider the control groups in these trials to largely represent usual care where there may be some form of screening.

Although 11[105-112,115,116,118] trial authors reported on participant deaths by study group during follow-up, and some reported in some manner on loss of independence (e.g., five[105,109,112,116,117] reported on movement into long-term care), the multicomponent nature of most of the interventions prevented us from attributing effects on these non-vision outcomes to vision screening. The two studies[113,117] (n=630) with multifactorial designs and thus reporting on results specific to vision screening did not report on mortality of loss of independence by arm. No study reported on fractures, although two reported on falls that were attributed to vision screening, either because vision was an isolated intervention[113] or because of other reasons for attribution stated but not reported in detail.[110] One trial [106] reported on vision-related functional limitations using a validated questionnaire. Five[104,106,113,117,118] reported on distance visual acuity measured by charts, with variable numbers reporting on related outcomes of mean change in visual acuity across all participants (n=4), proportion of participants with impaired visual acuity changing for better or worse by ≥0.1 logMAR (n=1), or the proportion meeting a particular threshold (<20/60; n=1 or <20/40; n=2). Ten trials[105,107-112,114-116] reported on self-reported vision, as either (fair or worse) general vision or having problems in one or more tasks related to vision. No trials reported the harms of serious AEs (attributed to vision screening or its sequelae) or anxiety/stress from a diagnosis in situations of inaccessible treatment options.

We have some confidence that the results on vision outcomes are not confounded greatly by other components in the trials (e.g, medication review, nutritional assessment), but cannot rule this out; where it is more obvious there may have been considerable confounding (e.g., lighting

modifications) we provide comment in the results section and have incorporated this into our GRADE assessments of indirectness.

Methodological Quality of Studies

Table 2 shows a summary of the assessments by ROB domain for the trials. Sequence generation was described and adequate (low ROB) for most (13 of 15) trials, as was allocation concealment (10 of 15). For trials reporting subjective outcomes (n=11; i.e., self-reported vision or vision-related functioning), ratings were high ROB for the blinding domains, except for three RCTs having unclear ROB for participants/personnel because the control group did not receive the vision assessment at baseline and the providers were not in contact with the control group during the trial. For objective outcomes (i.e., measured visual acuity using charts), which are less prone to performance and outcome ascertainment biases (n=5), trials were rated as unclear ROB for these domains with the exception of one trial rated as low ROB for outcome assessment due to adequate blinding of personnel. Two RCTs were at high ROB, and six were at unclear risk, for incomplete outcome data; both RCTs at high ROB had >30% attrition in both groups for outcomes of interest to this review even when considering attrition due to deaths (e.g., intervention group: 42.1% of those alive vs. control group: 32.3% of those alive[106]). Both our methods and those of Smeeth et al.[89] (one of the reviews we integrated) largely guarded against selective outcome reporting; authors of 10 of the trials were contacted and 8 provided results, or clarified definitions, for outcomes of interest. Moreover, we had a fairly high response rate (23 of 31; 74%) for the studies we excluded for not having vision outcome data collected or as an objective of the study. Overall, ROB for subjective outcomes was considered high[105-112,114-116] and for objectives outcomes (i.e. visual acuity using standardized charts) was considered unclear[104,113,117,118] or high.[106]

Table 2. Risk of bias ratings for each domain

Study	Sequence Generation	Allocation Concealment	Blinding of Participants and Personnel		Blinding of Outcome Assessors		Incomplete Outcome Data		Selective Outcome Reporting	Other Biases*
			S	O	S	O	S	O		
Dapp 2011	L	L	H		H		H		L	U
Day 2002	L	L		U		U		L	U	L
Eekhof 2000	U	U	U		H		U		L	U
Haanes 2015	L	U		U		U		U	U	L
Harari	L	L	H		H		U		L	L

2008										
Lord 2005	L	L		U		L		U	L	L
McEwan 1990	L	U	H		H		U		L	L
Moore 1997	L	U	H		H		L		L	U
Newbury 2001	L	L	U		H		L		L	L
Smeeth 2003	L	L	H	U	H	U	H	H	L	L
Tay 2006	U	U		U		U		U	L	L
Van Rossum 1993	L	L	U		H		U		L	L
Vetter 1984	L	L	H		H		U		L	L
Vetter 1992	L	L	H		H		U		L	L
Wagner 1994	L	L	H		H		L		L	L

ROB: risk of bias; S = subjective; O = objective; L (green) = low ROB; U (yellow) = unclear ROB; H (red) = high ROB
Blank cells indicate scoring not applicable (i.e. no subjective or objective outcomes were reported by that study).
*Other source of bias was baseline imbalances between groups.

Detailed Findings by Outcome

No trial contributed data for mortality or loss of independance because of the i) inability to attribute any effects on these to vision screening alone when the interventions (13 trials) included multicomponent screening/assessments incorporating multiple health and functional domains, or ii) lack of reporting on these outcomes by group in those trials[113,117] (n=630) with results specific to a vision screen. All other outcomes were vision-related or directly attributed to vision screening.

Fractures

No trial reported on fractures although falls were considered to provide indirect evidence for this outcome. In a full-factorial trial randomizing patients (n=1,107) to vision improvement (screening using multiple objective tests [visual acuity, stereopsis, field of view] with referrals), strength and balance, home hazard management, or no intervention (8 groups in total) to reduce falls, Day et al.[113] reported no significant difference (incidence rate ratio [IRR], 0.91; 95% CI, 0.82 to 1.16) for total number of falls over 18 months between those receiving the vision screening (97.8 per 100 person years) compared with those not receiving this intervention (107.3 per 100 person years). The main effects model results (i.e., vision vs. no vision screening across all 8 groups) were used because of no significant interaction effect between groups, but we cannot rule out confounding on this outcome from the other interventions received by 75% of participants receiving vision screening. No significant difference was found in another 12-month trial reporting on falls attributed to poor vision (intervention: 4 of 45 vs. control: 3 of 44; RR,

1.30; 95% CI, 0.31 to 5.49). In a post hoc analysis of the Day RCT,[120] falls requiring medical treatment (7-9% of all falls) were shown to be less for the group receiving versus not receiving vision screening (RR, 0.65; 95% CI, 0.46 to 0.91 and IRR, 0.65; 96% CI, 0.44 to 0.97).

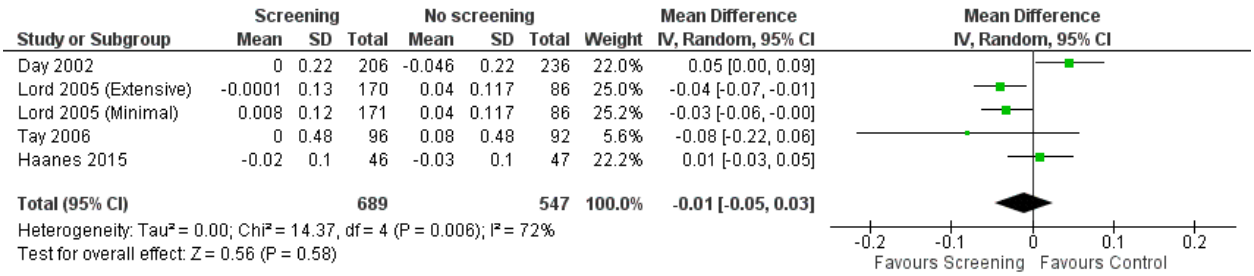
Vision-Related Quality of Life or Functioning

Smeeth et al.[106] conducted a sub-study (n=4,340) within a larger (n=42,319 from 103 general practices) Medical Research Council (MRC) cluster-RCT in the United Kingdom,[121] with random sampling of 10 practices within each group to which they offered to assess vision-related functioning and visual acuity at a median of 3.9 years follow up. Screening in this study consisted of measuring distance visual acuity with pinhole correction; referrals were provided to ophthalmologists (no pinhole/refractive correction) or optometrists (pinhole correction). After high attrition (37.4% in those still alive), the 25-item version of the National Eye Institute's Visual Function Questionnaire (NEI-VFQ-25; 0-100 range with higher scores better and an MID of 4-6 points[75]) was completed by 1,807 patients and showed no significant difference between groups (MD, 0.04 points; 95% CI, -1.7 to 2.5).

Impaired Visual Acuity

Four trials[104,113,117,118] using objective screening methods reported on mean change in,[104,113,118] or final,[117] distance visual acuity in logMAR units across all participants at follow-ups between 10 weeks[104] and 18 months[113] (median 12 months). Three trials[104,113,117] only reported p values for between-group change values, therefore 95% CIs and SDs were approximated using this data. The first author of one trial[118] provided individual patient data, so we calculated mean and variance measures for each group; we used results for this study's two intervention groups offering referrals (extensive) or brief advice/counselling (minimal) based on findings on vision from their Physiological Profile Assessment.[119] Meta-analysis found no significant difference between screening versus no screening (MD, -0.01 logMAR; 95% CI, -0.05 to 0.03) (Figure 3). Negative values represent improvement, and our MID for this outcome was 0.1 logMAR (5 letters or 1 line in the logMAR charts). Post-hoc subgroup analysis comparing results from trials having an isolated vision screening component (Day 2002 and Tay 2006) with those where vision was screened within a multicomponent intervention (Lord 2005 and Haanes 2015) did not reduce the heterogeneity or result in a statistically significant test for subgroup differences (p=0.70).

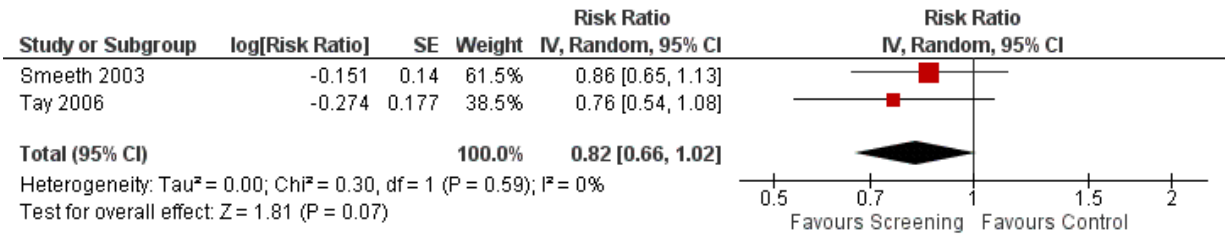
Figure 3. Visual Acuity (logMAR)



Analysis of individual patient data obtained for the Lord et al.[118] RCT (n=513) provided results for the proportion of patients with a change in visual acuity meeting or exceeding our MID of 0.1 logMAR (better or worse) at 6-month follow-up. This trial had two intervention groups providing referrals (extensive intervention) or brief counselling (minimal intervention) the data for both groups compared with the comparator of no intervention was similar (I^2=0%) so we combined the findings. Visual acuity worsened by ≥0.1 logMAR in fewer patients in the intervention groups than in the control group (RR, 0.55; 95% CI, 0.39 to 0.78; absolute effects: 126 fewer per 1000; 95% CI, 62 to 171 fewer), and also improved in more patients in the intervention groups (RR, 1.82; 95% CI, 1.08 to 3.08; absolute effects; 73 more per 1000; 95% CI, 7 more to 185 more).

Two trials[106,117] reported on impaired distance visual acuity using the proportion of patients having worse acuity than 20/60 and/or 20/40. Based on the 20/60 threshold in the trial by Smeeth et al.[106] (n=1,807), there was no significant difference between groups when measuring acuity in the better eye/bilateral vision (RR, 0.84; 95% CI, 0.64 to 1.10; absolute effect: 26 less per 1000; 95% CI, 60 less to 17 more) or in either eye (RR, 1.07; 95% CI, 0.84 to 1.36; absolute effect: 25 more per 1000; 95% CI, 54 less to 125 more) at a median of 3.9 years follow up. For visual acuity in either eye worse than 20/40, these authors also found no significant difference between groups (RR, 0.98; 95% CI, 0.82 to 1.17; absolute effect: 15 less per 1000; 95% CI, 108 less to 102 more). This study, and also that of Tay et al.[117] (n=121), measured bilateral vision worse than 20/40; results of our meta-analysis found no statistically significant difference (RR, 0.82; 95% CI 0.66 to 1.02; absolute effect: 67 fewer per 1,000; 95% CI, 7 more to 127 fewer) although there appeared to be some benefit from screening (Figure 4).

Figure 4. Impaired visual acuity: proportion of participants worse than 20/40 threshold in both eyes

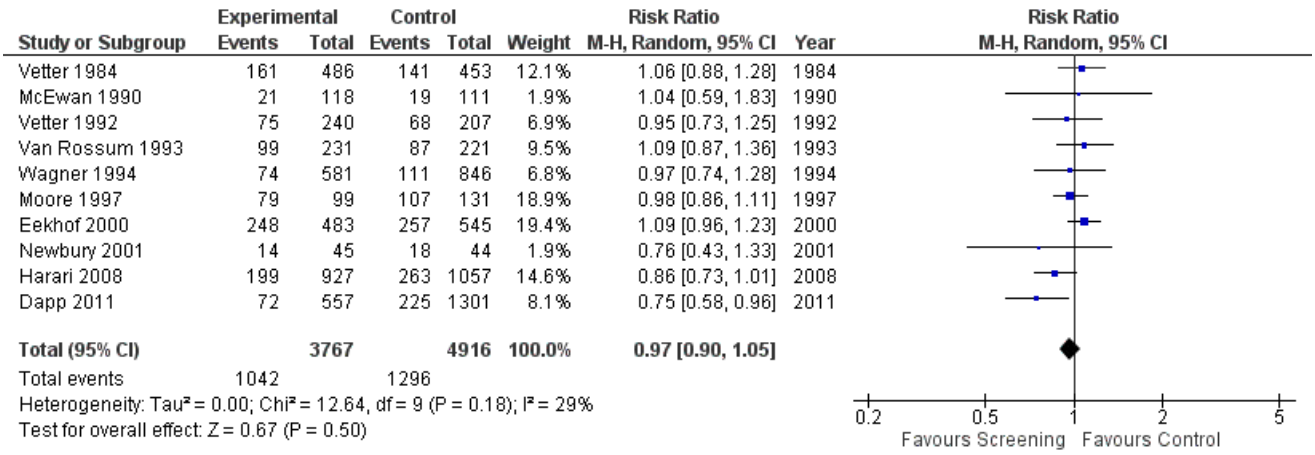


Self-Reported Vision

The vision screening in the majority of the trials (n=10) consisted of a self-reported measure of either general vision (e.g., very good or good vs. fair to poor or blind) or difficulties in one or more tasks related to visual acuity (e.g., reading newspaper at 40 cm) and/or other vision functioning (e.g., seeing objects in dim lighting); participants were instructed to answer questions in relation to problems when wearing usual spectacles. This outcome deviates from our planned outcomes of either self-reported vison-related functioning/quality of life, or visual acuity. The questions covered some but not all of those validated together to reflect vision-related functioning and quality of life (as would the VFQ-25 for an example); moreover, the questions used have been shown to have low-to-moderate (0.19 to 0.57) correlation with impaired visual acuity[1,122] and thus fairly poor sensitivity for this outcome.[30,89] We combined all outcomes together because of uncertainty on how patients interpret these questions, what other factors apart from visual function may contribute to the results (e.g., sociodemographic variables, depressed mood, and impaired cognitive function),[123,124] and whether there would be any reliable way to differentiate between these different questions in terms of their impact on patients. Even though difficult to accurately interpret, we did agree with others[122,123] that self-reported vision can complement more objective measures of visual acuity and has been used to measure the impact of visual impairment on health and physical function.[5,6,8,12]

Our meta-analysis of all 10 trials (n=8,683) found no significant difference in self-reported vision from screening using self-reported tools compared with usual care over a median duration of 20 months (RR, 0.97; 95% CI, 0.90 to 1.05; I^2=29%; absolute effect based on median control event rate of 31%: 9 fewer per 1,000; 95% CI, 16 more to 31 fewer) (Figure 5). Examination of the funnel plot and use of Egger's test (p=0.35) did not suggest any small study bias.

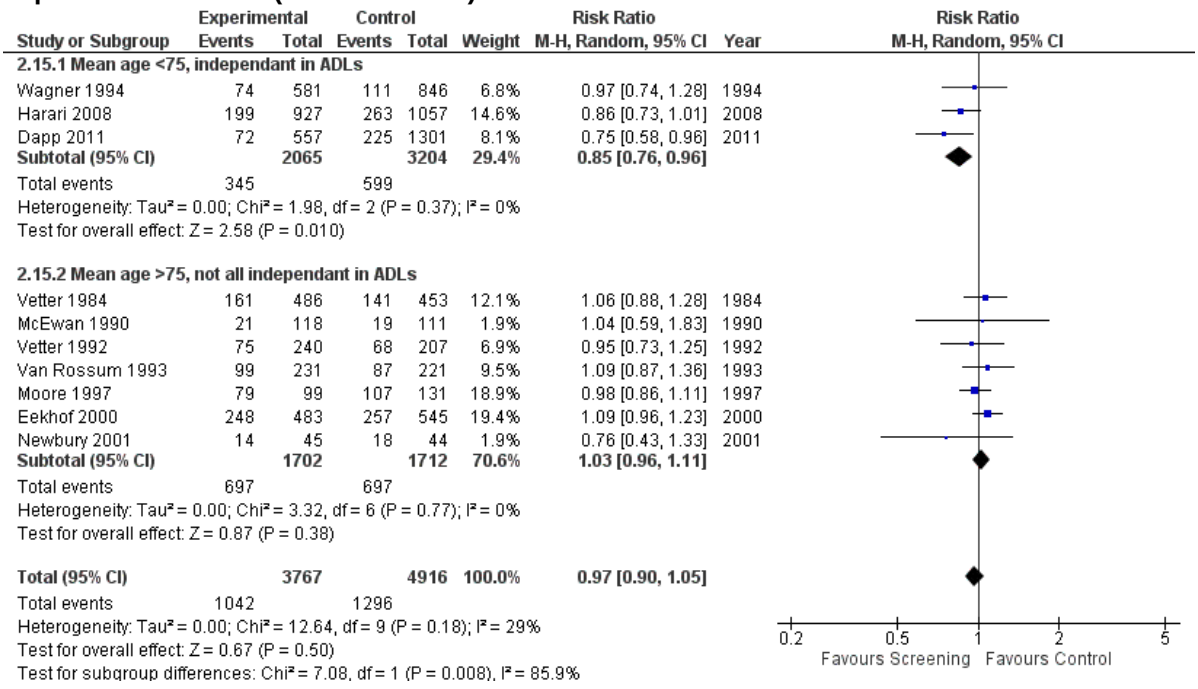
Figure 5. Self-reported vision problems: all studies



Although the statistical heterogeneity was not substantial based on the I^2 value, there was thought enough clinical and methodological heterogeneity between the studies to suggest differential effects may exist for some of our a priori defined subgroups. For these between-study analyses, we stratified the studies within the meta-analysis and deemed the analysis explanatory based on visual inspection of the forest plots (potentially meaningful difference between effect estimates), changes in the I^2 (each subgroup having greatly reduced heterogeneity from that found on the original meta-analysis), and statistical (Chi^2 testing) significance for subgroup effects. Several subgroup analyses (follow up duration [<24 vs. ≥24 months], intensity [1-3 total contacts vs. more; same studies as for follow up duration], screening personnel [physician or nurse vs. patient/office staff], setting [office vs. home-based], type of screening question [general vision vs. activity-related vision; same studies as for setting]) did not appear to explain the heterogeneity in the effects. The one analysis interpreted as explanatory is presented in Figure 6; younger patients (mean age <75 years) who are completely independent in ADLs (based on trial inclusion criteria) appear to benefit from vision screening (RR, 0.85; 95% CI, 0.76 to 0.96; absolute effect based on median control rate of 16.7%: 26 fewer per 1,000; 95% CI, 7 fewer to 41 fewer), while older patients (mean age ≥75 years of trial inclusion criteria above this age) with some having reliance on others for ADLs may not (RR, 1.03; 95% CI, 0.96 to 1.11; absolute effect based on median control rate of 39.4%: 12 more per 1,000; 95% CI, 16 fewer to 43 more). The test for subgroup differences was statistically significant (p=0.008), the I^2 values for both subgroups are 0%, and visual inspection of the findings indicates the possibility of a meaningful difference between groups. Nevertheless, these between-study analyses relied on use of study-level (mean age) rather individual-level data, and the relationship with patient averages across

trials may not be the same as the relationship for patients within trials;[95] the phenomenon is variously referred to as "aggregation bias" or the "ecological fallacy", and without individual patient data cannot be investigated.[125,126] Intervention rather than patient characteristics are easier to interpret because these characteristics will often have high variability across studies (e.g., dose, delivery personnel) compared to within studies. Further, potential for confounding by other between-study differences should be considered; one factor that may confound these effects is that the trials in the first subgroup all used a self-administered mailed questionnaire for screening. There was also no ability to compare the effects with those from different outcomes. The findings are considered to have some, but not a high degree, of credibility based on GRADE recommendations.[97]

Figure 6. Self-reported vision problems: subgroups based on age (mean age <75 vs. over 75) and dependence in ADLs (none vs. some)



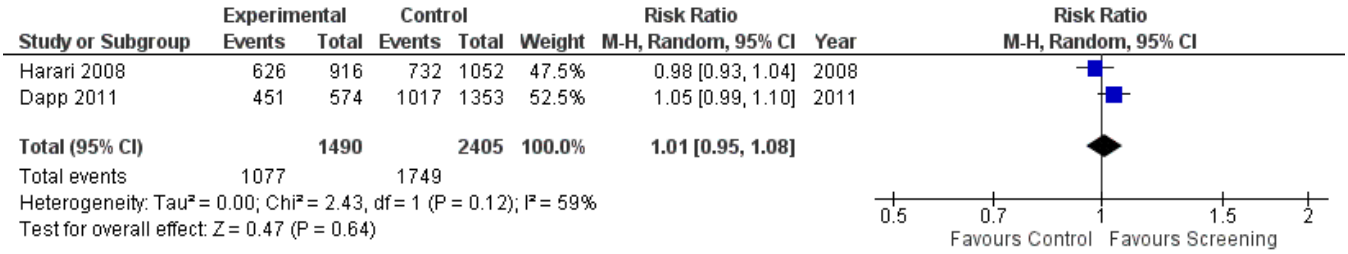
Harms: Serious Adverse Effects or Anxiety/Stress

No trial reported on serious AEs from screening or treating visual disturbances, or on anxiety or stress from diagnosis in the situation of limited or inaccessible treatment options or other causes.

Implementation Factors

Several studies reported on one or more of our outcomes related to implementation of screening programs; these outcomes might also reflect the utility of screening for changing clinical management and behaviors of patients. Two trials[112,116] reported on eye professional visits for both the intervention and control groups over 12 months. Our meta-analysis shown in Figure 7 for this outcome found no significant difference between groups (RR, 1.01; 95% CI, 0.95 to 1.08; RR > 1.0 favoring screening). The finding seems to contradict the one favoring screening for self-reported vision problems found within the subgroup including these studies, of relatively younger patients having dependence in their ADLs (Figure 6).

Figure 7. Eye professional visits over 12 months during trial



Seven[104-106,110,113,114,117] other trials reported on the proportion of patients screened positive for vision problems that actually received referrals to eye professionals and/or their physician (left columns in Table 3). Fewer than half (median 35%) of patients were referred although the range of 29 to 95% is large. Reflecting that many of the trials are comparing screening to usual care which may include screening, having data on the control group would have been informative. For example, Moore et al.[114] noted that 17 of 20 eligible people in their control group received referrals. In total for all participants receiving screening in these seven trials (n=3,225) there were 574 referrals provided (18% of those screened). Reasons provided by several trial authors were mostly related to these patients reporting care by eye professionals.

Five trials[104-106,113,117] reported on referral uptake for those provided with referrals to see an eye professional (right column in Table 3). The uptake was moderate (median 68%; range 18 to 96%). Not reported in Table 3, one additional trial reported moderate compliance (68%) to one of multiple recommendations (visit eye professional, wear hat/sunglasses in high-glare situations, turn light on at night).[118] For all participants screened in these five trials (n = 3,063), 231 patients (7.5%) likely received further assessment for their vision via referrals. This number may not,

though, represent those getting treatment; for example, in the Day trial[113] only 26 of 101 (26%) complying with referrals received treatment (20 new glasses and 6 surgeries); of the overall population getting screened (n=543) only 5% received treatment. Similarly, in the Smeeth trial[106] 34 of 1,565 getting vision assessed (2%) received new glasses (n=18) or cataract surgery (n=16).

Table 3. Referrals provided to patients screening positive (*left*) uptake of referralsprovided (*right*)

Study	Referrals	Number Screened positive	%	Study	Uptake	Referrals	%
Moore 1997	19	20	95%	Moore 1997	NR		
Eekhof 2000	79	268	29%	Eekhof 2000	33	79	42%
Newbury 2001	8	24	33%	Newbury 2001	NR		
Day 2002	101	287	35%	Day 2002	97	101	96%
Smeeth 2003	299	451	66%	Smeeth 2003*	68	115	59%
Tay 2006	57	96	59%	Tay 2006*	31	36	86%
Haanes 2015	11	38	29%	Haanes 2015	2	11	18%
Total (N=3,225 in intervention groups)	574	1184	Median 35%, Range 29-95%	**Total (N=3,063 in intervention groups)**	231	342	Mean 68%, Range 18-96%

*Data on uptake of referrals was not available for all patients receiving referrals.

Within-study Subgroup Analyses

We collected data from study reports on any within-study analyses conducted evaluating the possibility of differential effects for subgroups on patient and intervention characteristics. Smeeth et al.[106] reported that the effects on impaired visual acuity (<20/60 and <20/40) or vision-related functioning in their participants aged 75 years and older were not significantly different after adjustment for age, sex, level of self-reported visual difficulty at baseline, and time until follow up. Stratification by age, sex, level of self-reported visual difficulty at baseline, social isolation, or time until follow up also produced no evidence of subgroup effects. These authors also found that people with worse vision were more likely to be referred, and that people with evidence of cognitive impairment at the time of screening were less likely to be referred. Our own between-study subgroup analyses are discussed within the main findings above for self-reported vision problems, which was the only outcome for which we examined any effects. Our findings suggest that vision screening using self-reported, but not validated tools, tools may be

more beneficial for relatively younger (<75 years) and independent older adults, than for those over 75 requiring some assistance; we interpret these with caution because this form of analysis is exploratory and may be confounded by other variables differing between studies.

Key Questions 2-4

This review followed a staged approach based on the quality of the body of evidence (using GRADE assessments) and the information needs of the CTFPHC for making a recommendation on this topic. The CTFPHC has found that the evidence from KQ1 does not indicate a favorable benefit-harm ratio across outcomes, therefore we have not examined the cost-effectiveness (KQ3; requiring certainty in favorable benefit-harm ratio) of screening programs. Older adults' valuation of benefit and harm outcomes (KQ2) has not been examined either because there was not considerable uncertainty in the balance of benefits and harms as judged by the CTFPHC. Adding findings from evidence on accuracy of screening tests (KQ4), as indirect evidence on the clinical effects of screening for vision would not improve the certainty enough to change the strength or direction of a recommendation.

Quality of Evidence

Our GRADE Summary of Findings and Evidence Profile tables at the end of this report include all findings discussed in more detail above as well as our GRADE assessments on the quality of the body of evidence for each outcome; the reasons for each GRADE decision are included in the table footnotes. The GRADE assessments form the basis of our conclusions on the current evidence base for each outcome, which are summarized in the discussion below.

Section V. Discussion

We reviewed the evidence from 15 RCTs examining the effects of screening for vision—mostly within multicomponent screening/assessments—compared with no screening or usual care, for community-dwelling older adults (≥65 years) within settings applicable to primary health care.

Summary of Findings and Quality of Evidence

In this section we briefly summarize the evidence for each outcome, and provide our interpretations for each based on our GRADE assessments (ES 1 GRADE Summary of Findings table).

Mainly because the outcomes of mortality and loss of independence could not be attributed specifically to the vision component of multicomponent interventions, no trial provided evidence for these outcomes. No trial reported any harm that could be attributed to vision screening. Given the small number—5 to 10% at most suggested using the findings on implementation factors—of patients that appear to have received any treatment by eye care professionals during follow up, the number of serious AEs from treatment, if reported, would likely have been very small; in this case very large screening studies would be necessary to provide precise findings for these outcomes. Moreover, other harms relevant to screening interventions (e.g., resulting from unnecessary interventions from false-positives) would be minimal in this situation where any invasive procedures would be undertaken after diagnosis.

Two trials (n=1,180) reported on a surrogate outcome (falls and falls requiring medical treatment) for fractures that were attributed to vision screening over follow-up durations of 12 to 18 months. The quality of evidence for the outcome of fractures was assessed by GRADE methods as very low, and therefore we are very uncertain about the effects of screening with multiple vision tests on fractures over medium-term follow-up.

With low quality evidence from one RCT (n=1,807), screening with objective tools of visual acuity may make little to no difference in vision-related functioning over long-term follow-up

(NEI-VFQ-25, range 0-100; MID 4-6 points; MD, 0.4 units higher for universal screening; 95% CI, -1.25 to 2.05 units).

Screening with multiple objective vision tests probably makes little to no difference in high-contrast, distance visual acuity for older adults over medium-term follow-up (4 RCTs; n=1,236; MD, -0.01 logMAR; 95% CI, -0.05 to 0.03). One RCT (n=519) found that screening with multiple objective vision tests may reduce the proportion of patients having their high-contrast, distance visual acuity worsen (RR 0.55, 95% CI 0.39 to 0.78; absolute effect, 126 fewer per 1000; 95% CI, 62 to 171 fewer) and/or improve (RR, 1.82; 95% CI, 1.08 to 3.08; absolute effect, 73 more per 1000; 95% CI, 7 more to 185 more) by a marginal degree (MID 0.1 logMAR) over medium-term follow-up. We are very uncertain about the effects of screening using tests of visual acuity on the proportion having impaired visual acuity worse than 20/60 in both eyes or in either eye after long-term follow-up (1 RCT; n=1,807). Screening with objective tools appears to make little to no difference for bilateral impaired visual acuity (proportion with worse than 20/40) over medium-to-long term follow-up (2 RCTs; n=1,967; RR, 0.82; 95% CI, 0.66 to 1.02; absolute effects, 67 fewer per 1,000; 95% CI, 7 more to 127 fewer), although results indicated benefit may occur for some. It may make little or no difference for impaired visual acuity (proportion with worse than 20/40) in either eye over long-term follow up (1 RCT; n=1,807; RR, 0.98; 95% CI, 0.82 to 1.17; absolute effect, 15 less per 1000; 95% CI, 108 less to 102 more).

Moderate quality evidence from 10 RCTs (n=8,683) comparing self-reported screening with usual care found no significant difference for self-reported vision problems (RR, 0.97; 95% CI, 0.90 to 1.05; absolute effect, 9 fewer per 1,000; 95% CI, 16 more to 31 fewer) over a median follow-up of 20 months. Most of our planned subgroup analyses—follow-up duration, screening personnel, setting, and type of screening question—did not appear to explain the heterogeneity in the effects. Based on our criteria, the analysis deemed most explanatory compared studies of relatively younger patients (mean age <75 years) who were completely independent in ADLs (3 RCTs; n=5,269) with those of older patients (e.g., recruitment of 75 and older) with at least some relying on others for ADLs (7 RCTs; n=3,414) (RR, 0.85; 95% CI, 0.76 to 0.96 vs. RR, 1.03; 95% CI, 0.96 to 1.11, respectively; p=0.008 between groups, I^2=0% for both; possibly meaningful difference between effect sizes). The results are observational in nature, and the

potential for confounding by other between-study differences should be considered. Further research is warranted to explore this finding.

The lack of impact found by the investigators of these trials might be attributed in part by limited follow-up for screen-positive patients; only about a third (median 35%) of patients screening positive were referred to eye professionals—most of the remaining (65%) screen-positives were not provided referrals because of report of current care by eye professionals—and uptake of referrals by patients who were provided them was moderate (median 68%) and might not represent those receiving treatments (e.g., ≤5% of those screened in two RCTs received treatment).

Findings in Comparison with Other Systematic Reviews

Three other systematic reviews specific to vision[43,89,103] warrant comparison with ours in terms of their scope and findings. The use of questions about visual problems as a screening tool and the lack of clear plans of intervention for those people found to have a visual problem were proposed as explanations for the lack of effectiveness of screening for visual impairment (within multicomponent interventions) in community settings found in a 1998 systematic review of RCTs[107-109,111,115] by Smeeth and Iliffe.[127] A 2006 update of this review, including findings from an RCT (using objective screening tests and planned follow up for the vision component) led by one of the review authors,[106] found similar effects of no significant difference when considering self-reported vision problems, vision-related functioning, and impaired visual acuity. The authors comment that although an isolated vision screening intervention may produce greater effects, the likelihood of this occurring in clinical practice is small which limits the pragmatic aspects of such a trial. Findings of no difference from vision screening from the two RCTs[113,117] we included that isolated a vision intervention would not support this view (Figure 5). When considering other reasons for no effect on impaired visual acuity, these authors also comment on how among those (around half) who attended an ophthalmologist following screening but had no improvement in visual acuity there could have possibly been benefit in terms of function and quality of life from interventions for low vision that would not be expected to improve visual acuity.[89] However, the result for visual function (NEI-VFQ-25) in their RCT[106] did not differ in the two trial arms either.

A more recent systematic review by Chou and colleagues[43] also found no significant difference from screening for vision problems based on three RCTs[105,106,114] where screening mainly took place in physician offices (included the Smeeth trial where >30% of screening took place in participant homes, but excluded [based on 2009 report] another trial undertaken in a clinic[115]). This review differs from ours in that the CTFPHC considered home and other community settings as relevant to primary care; we considered that multiple settings could provide relevant findings so long as eye professionals were not undertaking screening, populations met inclusion criteria for this review, and the screening approach was considered feasible for primary care settings. We are not sure on the reason that we included some studies (e.g., Harari and Dapp RCTs in physician offices) not reviewed by Chou et al.; these trials are not located in their excluded studies lists, which could indicate that their search strategy (focusing on vision screening) was not as sensitive as ours (including multiple terms for multicomponent/falls risk/geriatric assessments) to capture studies where vision was screened within broader health risk assessments. Chou et al. also undertook additional reviews on the indirect evidence on accuracy of screening tests and of benefits and harms from treatment (compared with placebo, sham, or no treatment). The authors concluded that (i) screening questions or a questionnaire are inaccurate compared to a visual acuity test (e.g., the Snellen eye chart) and (ii) visual acuity tests have suboptimal (and variable) accuracy compared to a comprehensive ophthalmological examination. Although using the Snellen chart as a reference standard may be viewed by some as problematic, this first finding aligns well with other reports[1,122] finding a moderate (at best) correlation between self-reported vision and visual acuity; self-report may correlate better with other visual functions or conditions, and/or be confounded by factors unspecific to vision. The finding that a visual acuity test had less accuracy for detecting visual conditions compared with a comprehensive eye examination was not surprising because of unclear clinical significance of testing visual acuity for some visual conditions. Chou et al. also comment on one trial[128] (n=616; not meeting their inclusion criteria) that reported an increased risk of falls and a trend toward increased risk of fractures (18 control events) among frail older adults who underwent vision assessment by an optometrist versus usual care; this finding contrasts with that of a meta-analysis including this trial by Zhang at el.[103] finding a reduction in the incidence of falls (OR, 0.39; 95% CI, 0.07 to 0.70) in four trials of vision interventions (including referrals and first cataract surgery) versus no intervention. This review by Zhang et al focusing on vision interventions and

falls included two of the same studies as ours (focused on screening but not by optomtetrists),[113,118] but also others that directly provided vision treatments in high-risk populations (residential care) or people with known vision conditions.

Limitations of Evidence Base

The evidence base did not allow for findings on mortality or loss of independence because of either the inability to attribute causation on these health outcomes from changes in vision (within 13 multicomponent interventions), or because of lack of reporting by arm in the two trials with an isolated vision component. Less confounding was apparent in two trials that we used for indirect evidence on fractures. Nevertheless, although many factors will contribute to risk for loss of independence or fractures, impaired vision is arguably an important risk factor which also contributes to several better recognized risks.[129,130] It is unclear to what extent our outcomes of impaired visual acuity and self-reported vision problems would capture the possible benefits from vision screening. Although impaired visual acuity correlates with visual functioning and quality of life, other aspects of vision including visual cognition (visual attention, processing) may be important, yet under-investigated, such that optimal screening in primary care settings could be difficult without integrating multidisciplinary approaches.[130] Self-reported vision has been associated with health and functioning,[5,6,8,12] and this outcome may complement those from tests on visual acuity when determining the overall effects of vision interventions;[122] one should likely bear in mind, though, that there is uncertainty about the direction (or existence) of a casual association of impaired vision with some outcomes including mental health (depression)[3] and cognitive impairment. Similar pathological mechanisms seem to exist for visual conditions (e.g., AMD) and cognitive impairment (indicating comorbidity), yet impaired vison may also reduce the quality of interactive experiences of older adults and thus ultimately negatively affect physical, mental, and psychosocial behaviours.[131]

The quality of evidence was limited for all outcomes by potential biases threatening internal validity, mainly from lack of blinding patients, personnel and outcome assessors (especially for self-reported outcomes) or by high attrition, even after deaths were considered. For most outcomes, we considered the evidence reasonably applicable to our PICOTs so did not downgrade the evidence for indirectness; the outcomes of fractures (using surrogate outcome of

falls) and visual acuity (mean change) were the only ones downgraded for this GRADE domain. For visual acuity this downgrading was because of two studies enrolling only patients that were considered at higher-risk than the average population in primary care,[104,117] and one of these also providing an intervention (home lighting modification) thought to possibly confound results for a vision outcome. Although we did not downgrade other outcomes for indirectness, there is concern about the applicability of the results to the current Canadian primary health care system where better follow-up to screening may occur; this may particularly relate to locations where there are active programs for integrated primary health care or linkages with multidisciplinary vision rehabilitation for seniors, and/or situations when possible barriers such as cost of prescription glasses or devices are minimal for the patient because of private insurance or other assistance programs. Moreover, the positive effects on self-reported vision found in the studies of Dapp et al.[112] and Harari et al.[116] resulted from a system where electronic health records and "problem area" notifications were integrated, which is not standard practice at this time in Canada.

Interpretation of the effects may need to consider that the subjective outcome of self-reported vision was reported by studies using self-reported screening, and the objective outcomes where visual acuity was measured can be attributed to screening with similar tests; similar findings of little to no effect across most outcomes appears to allow for similar interpretations between screening methods. For self-reported vision, although several trials included assessment of factors that could theoretically impact vision if treated (e.g., medication review, nutrition assessment) we are making the assumption that the vision screening would have been the largest contributor to any beneficial effect. Any exaggeration in effect may have been offset by findings that people may not self-report vision problems (and hence receive any follow-up) despite having a reduced visual acuity as shown through objective means.[15] Precise and consistent findings of little or no difference for this outcome do not suggest substantial confounding existed by either factor.

There should be some consideration that the trials in practice did not focus only on patients with unrecognized vision problems (i.e., they recruited patients who reported having an eye care provider as well as those who did not). It is likely that excluding patients who were already receiving eye care would change the baseline rate of impaired vision in the group of trial

participants, thus probably increasing the proportion of participants in a position to benefit from screening. Conversely, patients who do not already have an eye care provider may be less likely, on average, to follow through with referral recommendations following a positive screening test. These factors could mean that the absolute (and possibly relative) effects of the same screening intervention, in patients with unrecognized vision problems, might be different from that observed in the more mixed group of participants. Moreover, the results as they are reported here, though, may best represent a typical primary care setting where a vision screen may be given to all patients. In 10 of the trials the control group patients received some form of vision assessment, and may have also received referrals to eye professionals as part of usual care; results across many outcomes may underestimate what may occur should a practitioner newly initiate screening and referrals into practice. There is a possibility that the findings would have been different should we have received data for two trials without records available as per author contact, or if authors of some trials had data from vision outcomes despite no indication of this in the reporting (and therefore excluded based on insufficient reporting to prompt author contact).

Limitations in Evidence Synthesis

This review followed rigorous methodological standards, which were detailed a priori in a protocol. Nevertheless, several limitations are inherent within systematic reviews in general. There is a possibility of selective reporting bias (e.g., researchers only reporting positive outcomes) and small study bias (including publication bias), whereby small trials are only published when unexpectedly strong results are found. In terms of selective outcome reporting, the findings of no effect reported by many studies of differing sizes, and our successful contacts with several authors to confirm or obtain data helped minimize this effect. Our pre-specified tests for publication bias (small study effects) indicated no bias for the outcome of self-reported vision, the only outcome reported by eight or more studies. Moreover, vision outcomes were not the primary outcomes reported by studies, which would reduce their likelihood of leading to publication bias. We focused on studies published in English or French, and trials published in other languages may have differing results; effect sizes in language restricted reviews have shown to not differ significantly (overestimating effect sizes by 2%) from those not having restrictions.[132] We based our assessments of the risk of bias on study publications and did not contact authors to verify the methods used. Some studies may have been adequately conducted,

but the methods were poorly reported. Our findings for the planned subgroup variables are based on study-level data (e.g., average patient age) and should be considered observational in nature and thus of low quality especially for the magnitude of difference in effect. Discussion on interpreting subgroup analyses with caution is included in the results section; further research would be required to further examine this finding. Systematic reviews may become outdated, at least in part, if new studies are published that change some or all of their conclusions. This review should be revisited should new studies become available that appear to indicate a different quality of evidence particularly with respect to harms or the outcomes of fractures or loss of independence.

Conclusions

Evidence was either not found or of low quality for most outcomes considered most critical for decision making by the CTFPHC for screening for impaired visual acuity or vision-related functional limitations for older, community-dwelling adults in primary health care settings. No study contributed findings for mortality, loss of independence, or harms specific to vision screening; the quality of evidence available for the outcome of fractures was very low such that we cannot make any conclusions on the effects. Screening probably makes little to no difference for mean distance visual acuity over medium-term follow-up across populations of older adults. It also may make little to no difference for vision-related functional limitations and we are not certain about the effects on the number of patients with impaired visual acuity meeting clinically relevant thresholds (e.g., worse than 20/60). Low quality evidence found that there may be some benefit in the number of patients having their vision worsen or improve by a marginal degree (0.1 logMAR=5 letters). For an added outcome of self-reported vision problems, screening probably makes little to no difference; studies where the average patient age was relatively younger (< 75 years) and all patients were independent in ADLs at baseline showed a greater effect for this outcome than those of older patients with at least some requiring assistance with ADLs, although other confounding factors may exist between these groups of studies and the findings are considered exploratory and in need of further research. The results of largely no effect across outcomes could relate in part to a fairly low referral rate by clinicians for those patients screening positive (due to reports of regular eye care), moderate uptake of referrals by patients, and low numbers of patients receiving treatments. Findings are most applicable to

screening all older adults in primary care, and not for those seeking and receiving care by eye professionals or other providers working in visual rehabilitation settings where comprehensive assessments and treatment/services would be directly provided.

ES 1. Grade Summary of Findings Table and Evidence Profile for KQ1

Vision screening compared to no vision screening/usual care in adults ≥65 in primary care

Patient or population: adults ≥ 65 years of age, with undetected impaired visual acuity or vision-related functional limitations

Setting: primary care

Intervention: vision screening

Comparison: no vision screening or usual care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no vision screening/usual care	Risk with vision screening				
Mortality				-	-	0 studies reported on this outcome in a manner that was attributable to vision screening.
Potential adverse consequences of poor vision (fractures) Assessed with self-report logs with follow up Follow up range 12 months to 18 months	Day 2002: Falls requiring medical treatment: IG 49/547 vs CG 75/543 **48 fewer per 1000** (12 to 75 fewer) Any fall: IG 691/547 vs CG 757/543; **163 fewer per 1000 (28 to 292 fewer)** Newberry 2001: Any fall: IG 4/45 vs. CG 3/44 **20 more per 1000** (48 less to 305 more)		Day 2002: Requiring medical treatment **RR** 0.65 (0.46 to 0.91); **IRR** 0.65; 95% CI 0.44 to 0.97 Any fall **RR**, 0.88; 95% CI, 0.79 to 0.98); **IRR**, 0.91; 95% CI, 0.82 to 1.16 Newberry 2001: Any fall **RR** 1.30 (0.31 to 5.49)	1180 (2 RCTs)[110,113]	⨁◯◯◯ VERY LOW	We are very uncertain about the effects of screening with multiple vision tests on fractures over medium-term follow-up.[a]
Potential adverse consequences of poor vision (loss of independence)				-	-	0 studies reported on this outcome in a manner that was attributable to vision screening.

Vision screening compared to no vision screening/usual care in adults ≥65 in primary care

Patient or population: adults ≥ 65 years of age, with undetected impaired visual acuity or vision-related functional limitations

Setting: primary care

Intervention: vision screening

Comparison: no vision screening or usual care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no vision screening/usual care	**Risk with vision screening**				
Vision-related functional limitations/quality of life Assessed with NEI-VFQ-25 scale from 0 to 100 (higher scores better) Follow up median 3.9 years	The mean vision-related functioning/quality of life was **0** Units	The mean vision-related functioning/quality of life in the intervention group was 0.4 Units higher (1.25 lower to 2.05 higher)	-	1807 (1 RCT)[106]	⨁⨁◯◯ LOW	Screening with objective tools of visual acuity may make little or no difference in vision-related functioning over long-term follow-up.[b]
Impaired visual acuity (mean change in high contrast distance visual acuity) Screening with objective screening; threshold for minimally important difference was 0.1 logMAR, or 5 letters. Follow up median 12 months.	The mean change in visual acuity was **0** logMAR	The mean visual acuity in the intervention group was **0.01 logMAR lower** (0.05 lower to 0.03 higher)		1343 (4 RCTs)[104,113,117,118]	⨁⨁⨁◯ MODERATE	Screening with multiple objective vision tests probably makes little to no difference in high-contrast, distance visual acuity over medium-term follow-up.[c]

Vision screening compared to no vision screening/usual care in adults ≥65 in primary care

Patient or population: adults ≥ 65 years of age, with undetected impaired visual acuity or vision-related functional limitations

Setting: primary care

Intervention: vision screening

Comparison: no vision screening or usual care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no vision screening/usual care	**Risk with vision screening**				
Impaired visual acuity (≥0.1 logMAR change for worse or better) Screening with objective tools. Follow up 6 months	Lord 2005: Worse VA (≥0.1 logMAR): Lord 2005 (n=519): IG 53/341 vs. CG 50/178 **126 fewer per 1000** (62 to 171 fewer) Better VA (≤ -0.1logMAR): Lord 2005 (n=519): IG 56/341 vs CG 16/178 **73 more per 1000** (7 more to 185 more)		Worse VA: **RR 0.55**, 95% CI 0.39 to 0.78 Better VA: **RR 1.82**, 95% CI 1.08 to 3.08	519 (1 RCT)[118]	⨁⨁◯◯ LOW	Screening with multiple objective vision tests may reduce worsening and/or improve high-contrast, distance visual acuity over medium-term follow-up.[d]
Impaired visual acuity (<20/60 distance visual acuity: bilateral or either eye) Screening with objective screening. Follow up median 3.9 years.	Smeeth 2003: Bilateral: IG 114/817 vs. CG 160/962 **26 less per 1000** (60 less to 17 more) Either eye: IG 307/829 vs. CG 339/978 **25 more per 1000** (54 less to 125 more)		**Bilateral: RR, 0.84** (0.64 to 1.10) **Either eye: RR, 1.07** (0.84 to 1.36)	1807 (1 RCT)[106]	⨁◯◯◯ VERY LOW	We are very uncertain about the effects of screening using tests of visual acuity on impaired visual acuity (worse than 20/60) in both eyes or in either eye over long-term follow-up.[e]
Impaired visual acuity (<20/40 distance visual acuity; bilateral) Screening with objective screening. Follow up range 12 months to 46 months.	374 per 1,000	**307 per 1,000** (247 to 381)	RR 0.82 (0.66 to 1.02)	1967 (2 RCTs)[106,117]	⨁⨁◯◯ LOW	Screening with objective tools may make little to no difference for bilateral impaired visual acuity (worse than 20/40) over medium-to-long term follow-up.[f]

Vision screening compared to no vision screening/usual care in adults ≥65 in primary care

Patient or population: adults ≥ 65 years of age, with undetected impaired visual acuity or vision-related functional limitations

Setting: primary care

Intervention: vision screening

Comparison: no vision screening or usual care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no vision screening/usual care	**Risk with vision screening**				
Impaired visual acuity (<20/40 distance visual acuity: either eye) Screening with objective screening. Follow up median 3.9 years	Smeeth 2003: IG 486/829 vs. CG 584/978 **15 less per 1000** (108 less to 102 more)		**RR 0.98** (0.82 to 1.17)	1807 (1 RCT)[106]	⨁⨁◯◯ LOW	Screening with objective tools may make little or no difference for impaired visual acuity (worse than 20/40) in either eye over long-term follow up.[g]
Self-reported vision problems Assessed with self-reported questionnaires Follow up median 20 months	**Study population**		RR 0.97 (0.90 to 1.05)	8683 (10 RCTs)[105, 107-112, 114-116]	⨁⨁⨁◯ MODERATE	Screening using self-reported vision tools probably makes little to no difference for self-reported vision problems over medium-to-long term follow-up.[h]
	264 per 1,000	**256 per 1,000** (237 to 277)				
	Median					
	310 per 1,000	**301 per 1,000** (279 to 326)				
Serious or major adverse effects from treatment				-	-	0 studies reported on this outcome
Anxiety or stress from inaccessible or ineffective treatment				-	-	0 studies reported on this outcome

***The risk in the intervention group** (and its 95% CI) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

ADLs: activities of daily living; **CG:** Control group**; CI:** Confidence interval; **IG**: Intervention group; **MD:** Mean difference; **NEI-VFQ-25**: National Eye Institute Visual Function Questionnaire; **RR:** Risk ratio

Vision screening compared to no vision screening/usual care in adults ≥65 in primary care

Patient or population: adults ≥ 65 years of age, with undetected impaired visual acuity or vision-related functional limitations

Setting: primary care

Intervention: vision screening

Comparison: no vision screening or usual care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no vision screening/usual care	Risk with vision screening				

GRADE Working Group grades of evidence
High quality: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

Notes to assessments for all GRADE domains for each outcome.

[a] **Potential adverse consequences of poor vision (fractures): Very low quality of evidence**. Two RCTs (n=1,180) with unclear risk of bias reported on this outcome, with one (Day 2002) reporting on any falls and falls requiring medical treatment and one (Newberry 2001) reporting on any falls attributed to vision (methods of ascertainment not reported). Our assessment largely relies on the data for falls requiring medical treatment from the Day trial which used vision tests of visual acuity, stereopsis, and field of view; falls were reported in monthly logs with telephone follow up. The results of this outcome were downgraded **(-1) for inconsistency** from reliance largely on one trial, and **(-1) for indirectness** because the outcome was not fractures as rated as more critical than falls by the CTFPHC working group, and 75% of participants also received an exercise intervention or home hazard management which could have confounded the risk for falls. We also downgraded **(-1) for imprecision** because the OIS (about 225 total events with 0.13 control event rate) was not met.

[b] **Vision-related functioning/quality of life: Low quality evidence**. One RCT (n=1,807) using objective screening (Glasgow acuity chart) for all patients (universal screening) compared with few patients (5.5%, those meeting targeted screening criteria including multiple domains) reported on vision-related functional limitations/quality of life using a validated measure (Visual Functioning Questionnaire [VFQ-25]; range 0-100 with higher values better). This outcome was downgraded **(-1) for risk of bias** because Smeeth 2003 was high ROB for not blinding personnel, patients and outcome assessors, and for high and differential attrition [42 vs. 32% of those alive] and **(-1) for inconsistency** because of unknown effects from other studies. We did not downgrade for imprecision because OIS was adequate and the limits of the CI did not show any important benefit or harm based on our a priori threshold for minimally important difference of 4-6 points on this scale.

[c] **Impaired visual acuity (mean change in high contrast distance VA): Moderate quality evidence**. Four RCTs (n=1,343) with unclear risk of bias using multiple objective screening tools. This outcome was downgraded **(-1) for indirectness**, because two of the RCTs included many patients receiving home care (100% in Haanes 2015 and >40% in Tay 2006), and one provided additional intervention (home lighting modifications [Haanes 2015]) that may have influenced both groups' results. The results appear to be consistent and precise (95%CI does not suggest important benefit for either group for the estimate of no effect).

[d] **Impaired visual acuity (≥0.1 logMAR, or 5 letters change)**: **Low quality evidence**: Individual patient data provided by the first author of one trial (Lord 2005, n=519) allowed for analysis on this outcome. This trial had two intervention groups providing referrals (extensive intervention) or brief counselling (minimal intervention) based on findings on vision from their Physiological Profile Assessment; the data for both groups compared with the comparator of no intervention was similar (I^2=0%) so we combined the findings. We downgraded this outcome **(-1) for inconsistency** (one trial) and **(-1) for imprecision**, because the OIS of about 200 total events with control event rate 0.28 was not met.

[e] **Impaired visual acuity (<20/60 distance visual acuity: bilateral or either eye): Very low quality evidence.** One RCT (n=1,807) using objective screening for visual acuity (Glasgow acuity logMAR chart) in all (universal group) versus few (5.5%, targeted for multiple risk factors) patients reported on impaired visual acuity (<20/60; <6/18) in both or either eye. We downgraded this outcome **(-1) for risk of bias** (Smeeth 2003 had no blinding and high and differential attrition), **(-1) for inconsistency** (one study), and **(-1) for imprecision** (both estimates met OIS but lower [bilateral] and upper [either eye] boundaries of the CI cross our threshold of RR 0.75 to 1.25).

[f] **Impaired visual acuity (<20/40 distance visual acuity: bilateral): Low quality evidence**. Two RCTs (n=1,967) reported on bilateral impaired visual acuity (worse than 20/40). This outcome was downgraded **(-1) for risk of bias** (Smeeth 2003 unclear risk for no blinding and high risk for and differential attrition; Tay unclear ROB for all domains except selective outcome reporting) and **(-1) for imprecision** with OIS met but lower limit of CI (RR 0.66) indicating possible benefit despite estimate of little or no effect. Results are most applicable when screening using one or more objective tests of visual acuity.

[g] **Impaired visual acuity (<20/40 distance visual acuity: either eye): Low quality evidence**. One RCT (n=1,807) reported on impaired visual acuity in either eye (worse than 20/40). This outcome was downgraded **(-1) for risk of bias** (Smeeth 2003 unclear risk for no blinding and high risk for and differential attrition) and **(-1) for inconsistency** (one trial). The estimate of little to no difference is precise without indication of important benefit or harm based on our threshold limits of RR 0.75 or 1.25.

[h] **Self-reported vision problems (all studies): Moderate quality evidence**. Ten RCTs (n=8,683) using variety of self-reported screening tools, primarily with a question(s) on general vision (4 with single question) but some including multiple questions (4 asking on vision-related activities, and 2 including visual acuity measurement after positive self-report responses). Patients of a variety of ages and risk factors for frailty and/or falls were included but all met our inclusion criteria. Most sensitivity analyses (e.g. setting, screening personnel, duration of follow up) did not alter our overall quality assessment. This outcome was downgraded **(-1) for risk of bias** (i.e., no blinding of participants or providers in any study, high ROB from attrition in one study [Dapp 2011], and unclear ROB for allocation concealment in Eekhof 2000, McEwan 1990, and Moore 1997). Although there was some inconsistency (2 CIs not overlapping; I^2=29%) we did not have serious concerns for this domain. We did not downgrade for imprecision because the OIS was met and limits of the CI were within a RR of 0.75 and 1.25 when the estimates effect was of little or no difference. Overall, the results are generally applicable to the overall screening population of interest, for screening testing using self-report tools compared with usual care where some screening may take place.

GRADE Evidence Profile

Note: For footnotes see those under Summary of Findings Table

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	vision screening	no vision screening/usual care	Relative (95% CI)	Absolute (95% CI)		
Mortality - not reported												
-	-	-	-	-	-	-	0 studies reported on this outcome in a manner that was attributable to vision screening.				-	CRITICAL
Potential adverse consequences of poor vision: fractures (falls requiring medical treatment) (follow up: range 12 months to 18 months; assessed with: Self-report logs with follow up)												
2 [110,113]	randomised trials	not serious	serious [a]	serious [a]	serious[a]	none	Day 2002 (falls requiring medical treatment): IG 49/547 vs CG 75/543; RR, 0.65; 95% CI, 0.46 to 0.91 (AR 48 fewer per 1000 [12 to 75 fewer]), IRR 0.65; 95% CI 0.44 to 0.97 Day 2002 (any fall): IG 691/547 vs CG 757/543; RR, 0.88; 95% CI, 0.79 to 0.98) (AR 163 fewer per 1000 [28 to 292 fewer); IRR 0.91; 95% CI, 0.82 to 1.16 Newberry 2001 (any fall attributed to vision): IG 4/45 vs. CG 3/44; RR, 1.30; 95% CI, 0.31 to 5.49 (AR 20 more per 1000 [48 less to 305 more])				⊕◯◯◯ VERY LOW	CRITICAL
Potential adverse consequences of poor vision (loss of independence) - not reported												

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**vision screening**	**no vision screening/usual care**	**Relative (95% CI)**	**Absolute (95% CI)**		
-	-	-	-	-	-	-	0 studies reported on this outcome in a manner that was attributable to vision screening.				-	CRITICAL
Vision-related functioning/quality of life (follow up: median 3.9 years; assessed with: NEI-VFQ-25; Scale from: 0 to 100)												
1[106]	randomised trials	serious [b]	serious[b]	not serious	not serious	none	829	978	-	MD **0.4 Units higher** (1.25 lower to 2.05 higher)	⨁⨁◯◯ LOW	CRITICAL
Impaired visual acuity with objective screening (mean change in high contrast distance VA) (follow up: median 12 months)												

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	vision screening	no vision screening/usual care	Relative (95% CI)	Absolute (95% CI)		
4[104,113,117,118]	randomised trials	not serious	not serious	serious [c]	not serious	none	764	579		MD **-0.01** logMAR better (-0.05 better to 0.03 worse)	⊕⊕⊕◯ MODERATE	CRITICAL
Impaired visual acuity with objective screening (minimally important change [0.1 logMAR] in contrast distance VA) (follow up 6 months)												
1 [118]	randomised trials	not serious	serious [d]	not serious	serious [d]	none	Worse VA (≥0.1 logMAR): Lord 2005 (n=519): IG 53/341 vs. CG 50/178; RR 0.55, 95% CI 0.39 to 0.78 (AR 126 fewer per 1000 [62 to 171 fewer]) Better VA (≤-0.1logMAR): Lord 2005 (n=519): IG 56/341 vs CG 16/178; RR 1.82, 95% CI 1.08 to 3.08 (AR 73 more per 1000 [7 more to 185 more)				⊕⊕◯◯ LOW	CRITICAL

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**vision screening**	**no vision screening/usual care**	**Relative (95% CI)**	**Absolute (95% CI)**		
Impaired visual acuity with objective screening (<20/60 distance visual acuity: bilateral or either eye) (follow up: median 47 months)												
1[106]	randomised trials	serious [e]	serious [e]	not serious	serious [e]	none	Smeeth 2003: Bilateral: IG 114/817 vs. CG 160/962; RR, 0.84; 95% CI, 0.64 to 1.10 (AR 26 less per 1000 [60 less to 17 more]); Either eye: IG 307/829 vs. CG 339/978; RR, 1.07; 95% CI, 0.84 to 1.36 (AR 25 more per 1000 [54 less to 125 more])				⊕◯◯◯ VERY LOW	CRITICAL
Impaired visual acuity with objective screening (<20/40 distance visual acuity; bilateral) (follow up: range 12 months to 47 months)												
2 [106,117]	randomised trials	serious [f]	not serious	not serious	serious [f]	none	290/913 (31.8%)	394/1054 (37.4%)	**RR 0.82** (0.66 to 1.02)	**67 fewer per 1,000** (from 7 more to 127 fewer)	⊕⊕◯◯ LOW	
Impaired visual acuity with objective screening (<20/40 distance visual acuity: either eye) (follow up: range 12 months to 47 months; assessed with: Visual acuity charts (logMAR))												
1 [106]	randomised trials	serious [g]	serious [g]	not serious	not serious	none	Smeeth 2003: IG 486/829 vs. CG 584/978; RR, 0.98; 95% CI, 0.82 to 1.17) (AR 15 less per 1000 [108 less to 102 more])				⊕⊕◯◯ LOW	CRITICAL
Self-reported vision problems (primarily self-report screening tools) (follow up: median 20 months; assessed with self-reported questionnaires)												

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**vision screening**	**no vision screening/usual care**	**Relative (95% CI)**	**Absolute (95% CI)**		
10[105,107-112,114-116]	randomised trials	serious [h]	not serious	not serious	not serious	none	1042/3767 (27.7%)	1296/4916 (26.4%)	**RR 0.97** (0.90 to 1.05)	**8 fewer per 1,000** (from 13 more to 26 fewer)	⨁⨁⨁◯ MODERATE	CRITICAL
								31.0%		**9 fewer per 1,000** (from 16 more to 31 fewer)		
Serious or major adverse effects from treatment - not reported												
-	-	-	-	-	-	-	0 studies reported on this outcome				-	CRITICAL
Anxiety or stress from inaccessible or ineffective treatment - not reported												
-	-	-	-	-	-	-	0 studies reported on this outcome				-	CRITICAL

ADLs: activities of daily living; **CG:** Control group**; CI:** Confidence interval; **IG**: Intervention group; **MD:** Mean difference; **NEI-VFQ-25**: National Eye Institute Visual Function Questionnaire; **RR:** Risk ratio

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APPENDIX A. Methods for Integrating Existing Systematic Reviews into New Reviews

One or more systematic reviews may exist that align with one or more key questions (KQs) of the reviews undertaken to inform CTFPHC guidelines. The CTFPHC and ERSCs have considered the manner in which new reviews conducted for CTFPHC guidelines can benefit from efficiencies by incorporating existing systematic reviews, while maintaining methodological rigor in their own systematic review conduct, closely aligning existing reviews within their review scope (i.e., inclusion/exclusion criteria), and maintaining consistency with other CTFPHC Methods. They have based their approach on work conducted by a methods working group composed of investigators from the Evidence-based Practice Center Program funded by the U.S. Agency for Healthcare Research and Quality.[1,2] A summary of the way the ERSCs will operationalize the 12 AHRQ recommendations (Box 1) to meet their needs is outlined below. This approach differs from situations when "updating" a single existing systematic review is deemed suitable, that is, in some cases a high-quality review will be used to answer one or more of the CTFPHC KQs in entirety, usually without revisions to the review's scope, search for evidence (apart from updating to present), methodological quality/risk of bias assessments, data extraction, or data analysis.

Summary of CTFPHC Approach

The recommendations developed by AHRQ (Box 1) will serve as an overall framework for ERSC reviews, although in most cases existing systematic reviews will be used to build efficiencies in discrete steps within the review process—mainly search and selection of literature, and data extraction—which will not generally include refinement of the scope or data analysis and interpretation. Moreover, we will not in most circumstances include a systematic review itself as a study design for inclusion (unless the intention is to specifically conduct an overview of reviews). The ability to use any given systematic review will largely depend on how it aligns with the CTFPHC review's scope (PICOTS). A further primary consideration will be the comprehensiveness of its search strategy and reporting of literature flow. It is important to note that some CTFPHC reviews need to be complex with multiple stages (e.g., a review of screening effectiveness for patient-important benefits and harms may require including evidence on indirect evidence of test accuracy and treatment) such that existing systematic reviews may exist for one or more discrete stages but not for others. Some key points on the operationalization, and minor revision, by the ERSCs of these recommendations are provided below.

1. **Choosing systematic reviews**: Following the identification of relevant reviews (a search for systematic reviews may be undertaken for some topics), the evidence for each will be mapped to the PICOTS elements and the quality of the review will be assessed (e.g., using the AMSTAR tool which has been evaluated and found effective to discriminate reviews with high and low quality of methods and reporting).[3] Some of the CTFPHC

KQs may only have a single existing systematic review for possible incorporation, while others may have more than one; if suitable, a decision between systematic reviews will be based on methodological quality, comprehensiveness and quality of its literature search and reporting (e.g., assessed using PRESS checklist), comprehensiveness of reporting on included studies, and the best fit within the CTFPHC scope and methods. In some cases two or more reviews may be integrated because, together, they capture the full scope of the CTFPHC KQ(s). Rationale will be provided for choices made.

Note: If no review is deemed a good fit for purpose for integration (i.e., de novo process all together appears to be best option) we will at minimum examine available reviews for their search strategies (to ensure that our search strategies are comprehensive) and review their reference lists for identification of studies.

2. **Searching**: Various strategies will be considered. If one or more reviews are fit for purpose (but do not meet criteria for classification as a systematic review update) and cover a scope that is *very similar or broader* than the CTFPHC topic, we may update the search(es) if the last search date was prior to 6 months before commencing our review. When there are multiple reviews being considered, updating the literature to present may involve a new comprehensive search strategy to identify studies published after the date of the earliest existing review; this may reduce complexities when trying to implement, document, and remove duplicates from multiple searches. Alternatively, if the scope of the existing review(s) is *narrower* (e.g., missing an element in PICOTS) or the search *deemed sub-optimal in some manner* (e.g., missing key terms, additional database viewed as highly relevant) we may re-run the existing review's search concurrent with an original (e.g., broader) search and remove the citations previously screened for the other review. If more appropriate, we may update the other review's search and use a new search for the missing PICO element(s) (e.g., one additional intervention) for a longer time period to meet our timeframe. In cases where we feel screening excluded studies lists is appropriate we will also undertake this. Careful consideration will be used to ensure a comprehensive search is conducted regardless of approach taken; moreover, the ERSC librarians will help determine on a case-by-case basis what approach would be feasible for implementation to ensure aims of building efficiencies are possible.
3. **Screening and selection**: We will assess articles included in all relevant reviews (based on full text if necessary) to determine if they meet our inclusion criteria.
4. **Data extraction and methodological quality assessments**: We will consider incorporating the data on study and participant characteristics rather than extracting these data anew; we may also use the review author's risk of bias assessments if the tools/methods are consistent with CTFPHC methods. These steps will create efficiencies but because they are dependent on the quality of the systematic review and extent of reporting, the ERSC staff will verify the data on at least 5 to 10% of studies.[1]
5. **Data analysis**: We will consider using quantitative outcome data from reviews (with verification), but will not typically use meta-analyses or quality (GRADE) assessments of existing reviews.
6. **Reporting**: Transparent reporting of all integration steps used will be included in the evidence review report.

1. Existing reviews should be confirmed as systematic reviews through the application of a minimum set of eligibility criteria. We propose that the minimum eligibility criteria for systematic reviews include an explicit and adequate search, application of predefined eligibility criteria to select studies, risk of bias assessment for included studies, and synthesis of results.
2. Criteria to assess the relevance, in terms of question elements and currency, and quality of existing systematic reviews under consideration for inclusion in reviews should be predefined.
3. The quality of relevant existing systematic reviews should be assessed in an explicit manner with a minimum set of quality criteria that include search of multiple sources, use of a generally accepted tool for risk of bias assessment, and sufficient information to assess the strength of the body of evidence that includes the major domains of risk of bias, directness, consistency, precision, and reporting bias.
4. The risk of bias assessments from the existing systematic review may be used when the review described an explicit process, including the use of a tool or method that is compatible with the approach of the current review and that assessed the key sources of potential bias.
5. We suggest that risk of bias assessment be repeated in a sample of studies from an existing review under consideration for inclusion in a new review to confirm concordance with current review team approach.
6. We recommend that at a minimum, reviews should narratively describe findings of the prior review(s), including the number and types of studies included, and the overall findings.
7. We recommend that newly identified studies be clearly distinguished from studies in the existing review(s) when presented in the narrative and any tables (eg, separate tables).
8. Summary tables should include sufficient information to support ratings for overall strength of evidence, including ratings for individual strength of evidence domains (study limitations, consistency, precision, directness, reporting bias). The strength of evidence ratings should be based on the underlying primary evidence, not the number or quality of existing systematic reviews.
9. Using strength of evidence domains as a framework (study limitations, consistency, precision, directness, and reporting bias), review authors should consider how new evidence would change estimates of effect or ratings for strength of evidence. A new quantitative synthesis (ie, pooled estimate) is needed if new studies would change conclusions or strength of evidence judgements, or to obtain a more precise or more up-to-date estimate.
10. In cases where the existing systematic review(s) did not complete strength of evidence grading for a comparison and outcome of interest, the strength of evidence should be assessed for the body of evidence, considering primary studies from prior review(s) and any new studies identified.
11. In cases where no new studies are added to the body of evidence, the strength of evidence assessment from the existing systematic review may be used if conducted using an acceptable grading approach consistent with current review context. In these cases, we suggest that the overall strength of evidence assessment be reviewed, considering the strength of evidence domains, to confirm consistency with current review team assessments.
12. In cases where new studies are added to the body of evidence, the strength of evidence may need to be reassessed on the basis of all studies/evidence.

Box 1. AHRQ recommendations on integrating existing systematic reviews for new systematic reviews.

[1]Robinson KA, Chou R, Berkman ND, et al. Integrating bodies of evidence: existing systematic reviews and primary studies. Methods Guide for Effectiveness and Comparative Effectiveness Reviews [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2015 Feb.

[2]Robinson KA, Chou R, Berkman ND, et al. Twelve recommendations for integrating existing systematic reviews into new reviews: EPC guidance. J Clin Epidemiol. 2016 Feb;70:38-44. PMID: 26261004.

APPENDIX B. Database Search Strategies

MEDLINE: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present

1. *Accidental Falls/pc
2. *Cataract/di, pc
3. *Eye Diseases/di, pc
4. *Macular Degeneration/di, pc
5. *Vision Disorders/di, pc
6. Vision Screening/
7. Vision Tests/
8. exp Visual Acuity/ and (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*).tw,kf.
9. Amsler.tw,kf.
10. ((AMD or ARMD or cataract* or eye or eyes or macular degeneration or ocular or ophthalm* or visual or vision) adj3 (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*)).tw,kf.
11. (E chart* or E test*).tw,kf.
12. ((evaluat* or exam* or test*) adj3 (pin hole or pinhole)).tw,kf.
13. (fall* adj2 prevent*).ti.
14. funduscop*.tw,kf.
15. Jaeger.tw,kf.
16. Landolt*.tw,kf.
17. (Log-Mar* or LogMAR*).tw,kf.
18. Snellen*.tw,kf.
19. or/1-18 [Combined MeSH & text words for vision screening - narrow]
20. Community Health Services/
21. Community Health Workers/
22. Early Diagnosis/
23. Family Practice/
24. Geriatric Assessment/
25. Health Promotion/
26. Health Status/
27. Home Care Services/
28. Home Health Nursing/
29. House Calls/
30. Mass Screening/
31. Nurses, Community Health/
32. Nursing Assessment/
33. Office Visits/
34. Primary Health Care/
35. Preventive Health Services/
36. ((assess* or detect* or diagnostic* or evaluat* or exam* or prevent* screen* or test*) adj5 (family doctor* or family practi* or family physician* or general practic* or GP or primary care or primary health care)).tw,kf.

37. ((assessment* or education or promotion*) adj1 health*).tw,kf.
38. ((care* or service* or support* or visit*) adj2 (communit* or domicil* or home* or out-reach* or outreach*)).tw,kf.
39. (communit* adj3 (out-reach* or outreach* or practice* or program*)).tw,kf.
40. ((clinician* or health or doctor* or nurse* or physician* or volunteer*) adj2 visit*).tw,kf.
41. (early and detect*).ti.
42. geriatric assessment*.tw,kf.
43. (pre-dispos* or predispos*).ti.
44. or/20-43 [Combined MeSH & text words for screening - broad]
45. (assess* or detect* or diagnostic* or evaluat* or exam* or prevent* or screen* or test*).tw,kf.
46. and/44-45 [text word filter on broad screening results]
47. or/19,46 [Combined screening sets]
48. exp Aged/
49. Geriatrics/
50. Health Services for the Aged/
51. (aged or ageing or aging or elder* or geriatric* or octogenarian* or septuagenarian* or senior*).tw,kf.
52. ((adult* or citizen? or client? or consumer? or female? or male? or men or patient? or people or person* or wom#n) adj3 older*).tw,kf.
53. or/48-52 [Combined MeSH & text words for older adults]
54. and/47,53 [Combined concepts for screening and older adults]
55. "Clinical Trials as Topic"/
56. controlled clinical trial.pt.
57. randomized controlled trial.pt.
58. placebo.ab.
59. random*.ab.
60. trial.ti.
61. or/55-60 [Modified Cochrane highly sensitive RCT filter: sensitivity and precision maximizing version]
62. exp Animals/ not Humans/
63. (animal or animal-model* or animals or canine* or cat or cats or dog or dogs or feline or felines or hamster or hamsters or mice or monkey or monkeys or mouse or pig or piglet or piglets or pigs or porcine or primate* or rabbit or rabbits or rat or rats or rodent or rodents or sheep or swine or swines).ti.
64. 61 not (62 or 63)
65. 54 and 64 [RCT & animal filter applied]
66. (Adolescent/ or exp Child/ or exp Infant/) not exp Adult/
67. Adolescent Medicine/
68. exp Pediatrics/
69. (paediatr* or pediatr*).jw.
70. (adolesc* or babies or baby or boy* or child* or fetal or fetus or foet* or girl* or infan* or juvenile* or kid or kids or neo-nat* or neonat* or new-born* or newborn* or paediatr* or pediatr* or preadolesc* or prepubesc* or preteen* or pubescen* or teen* or toddler* or youth*).tw,kf.
71. or/66-70 [Combined MeSH & textwords for pediatric studies]

72. 65 not 71 [Pediatric records excluded]
73. (comment or editorial or news or newspaper article).pt.
74. (letter not (letter and randomized controlled trial)).pt.
75. 72 not (73 or 74) [Opinion pieces excluded]
76. case reports.pt.
77. (case report* or case stud*).ti.
78. 75 not (76 or 77) [Case reports excluded]
79. diabetic retinopath*.ti.
80. 78 not 79 [Diabetic retinopathy articles excluded]
81. (glaucoma* not (glaucoma* and (AMD or ARMD or cataract* or macular degeneration* or vision or visual))).ti.
82. 80 not 81 [Glaucoma articles excluded]
83. (optometrist* or ophthalmologist*).ti.
84. 82 not 83 [Specialist articles excluded]
85. limit 84 to (english or french)
86. limit 85 to yr="2012-Current"

Ovid Embase 1996 to 2016 Week 35

1. *age related macular degeneration/di, pc
2. *cataract/di, pc
3. *eye disease/di, pc
4. *falling/pc
5. *macular degeneration/di, pc
6. *vision test/
7. *visual acuity/ and (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*).ti.
8. *visual disorder/di, pc
9. Amsler.tw,kw.
10. ((AMD or ARMD or cataract* or eye or eyes or macular degeneration or ocular or ophthalm* or visual or vision) adj3 (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*)).tw,kw.
11. (E chart* or E test*).tw,kw.
12. ((evaluat* or exam* or test*) adj3 (pin hole or pinhole)).tw,kw.
13. (fall* adj2 prevent*).tw.
14. funduscop*.tw,kw.
15. Jaeger.tw,kw.
16. Landolt*.tw,kw.
17. (Log-Mar* or LogMAR*).tw,kw.
18. Snellen*.tw,kw.
19. or/1-18 [Combined Emtree & text words for vision screening - narrow]
20. *community care/
21. *community health nursing/
22. *community program/
23. *early diagnosis/
24. *general practice/

25. *geriatric assessment/
26. *health promotion/
27. *health status/
28. *home care/
29. *mass screening/
30. *nursing assessment/
31. *preventive health service/
32. *primary health care/
33. *screening/
34. *screening test/
35. *visiting nursing service/
36. ((assess* or detect* or diagnostic* or evaluat* or exam* or prevent* screen* or test*) adj5 (family doctor* or family practi* or family physician* or general practic* or GP or primary care or primary health care)).tw,kw.
37. ((assessment* or promotion*) adj1 health*).tw,kw.
38. ((care* or service* or support* or visit*) adj2 (communit* or domicil* or home* or out-reach* or outreach*)).tw,kw.
39. (communit* adj3 (out-reach* or outreach* or practice* or program*)).tw,kw.
40. ((clinician* or health or doctor* or nurse* or physician* or volunteer*) adj2 visit*).tw,kw.
41. (early and detect*).ti.
42. geriatric assessment*.tw,kw.
43. (pre-dispos* or predispos*).ti.
44. or/20-43 [Combined Emtree & text words for screening - broad]
45. (assess* or detect* or diagnostic* or evaluat* or exam* or prevent* or screen* or test*).tw,kw.
46. and/44-45 [text word filter on broad screening results]
47. or/19,46 [Combined screening sets]
48. exp aged/
49. exp elderly care/
50. geriatrics/
51. (aged or ageing or aging or elder* or geriatric* or octogenarian* or septuagenarian* or senior*).tw,kw.
52. ((adult* or citizen? or client? or consumer? or female? or male? or men or patient? or people or person* or wom#n) adj3 older*).tw,kw.
53. or/48-52 [Combined Emtree & text words for older adults]
54. and/47,53 [Combined concepts for screening and older adults]
55. (double adj1 blind*).ti,ab.
56. placebo*.ti,ab,kw.
57. random*.ti,ab.
58. or/55-57 [Modified Cochrane recommended Embase RCT filter translated to Ovid format: sensitivity and precision maximizing version]
59. animals/ not (animals/ and humans/)
60. (animal or animal-model* or animals or canine* or cat or cats or dog or dogs or feline or felines or hamster or hamsters or mice or monkey or monkeys or mouse or pig or piglet or piglets or pigs or porcine or primate* or rabbit or rabbits or rat or rats or rodent or rodents or sheep or swine or swines).ti.

61. 58 not (59 or 60)
62. and/54,61 [RCT & animal filter applied]
63. exp juvenile/ not exp adult/
64. exp pediatrics/
65. (paediatr* or pediatr*).jx.
66. (adolesc* or babies or baby or boy* or child* or fetal or fetus or foet* or girl* or infan* or juvenile* or kid or kids or neo-nat* or neonat* or new-born* or newborn* or paediatr* or pediatr* or preadolesc* or prepubesc* or preteen* or pubescen* or teen* or toddler* or youth*).tw,kw.
67. or/63-66 [Combined Emtree & textwords for pediatric records]
68. 62 not 67 [Pediatric records excluded]
69. (conference* or editorial or letter).pt.
70. 68 not 69 [Publication types excluded]
71. case report/
72. (case report* or case stud*).ti.
73. 70 not (71 or 72) [Case reports excluded]
74. diabetic retinopath*.ti.
75. 73 not 74 [Diabetic retinopathy articles excluded]
76. (glaucoma* not (glaucoma* and (AMD or ARMD or cataract* or macular degeneration* or vision or visual))).ti.
77. 75 not 76 [Glaucoma articles excluded]
78. (optometrist* or ophthalmologist*).ti.
79. 77 not 78 [Specialist articles excluded]
80. limit 79 to (english or french)
81. limit 80 to yr="2012-Current"
82. remove duplicates from 81

Cochrane Library via Wiley

ID	Search
#1	[mh "Accidental Falls"/PC]
#2	[mh ^Cataract] and (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*):ti,ab,kw
#3	[mh ^"Eye Diseases"/DI,PC]
#4	[mh "Macular Degeneration"/DI,PC]
#5	[mh "Vision Disorders" [mj]/DI,PC]
#6	[mh ^"Vision, Screening"]
#7	[mh ^"Vision Tests"]
#8	[mh "Visual Acuity"] and (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*):ti,ab,kw
#9	Amsler:ti,ab,kw
#10	((AMD or ARMD or cataract* or eye or eyes or "macular degeneration" or ocular or ophthalm* or visual or vision) near/3 (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*)):ti,ab,kw
#11	("E chart*" or "E test*"):ti,ab,kw
#12	((evaluat* or exam* or test*) near/3 ("pin hole" or pinhole)):ti,ab,kw

#13 (fall* near/2 prevent*):ti
#14 funduscop*:ti,ab,kw
#15 Jaeger:ti,ab,kw
#16 Landolt*:ti,ab,kw
#17 (Log-Mar* or LogMAR*):ti,ab,kw
#18 Snellen*:ti,ab,kw
#19 133-#18
#20 [mh ^"Community Health Services"]
#21 [mh ^"Community Health Workers"]
#22 [mh ^"Early Diagnosis"]
#23 [mh ^"Family Practice"]
#24 [mh ^"Geriatric Assessment"]
#25 [mh ^"Health Promotion"]
#26 [mh ^"Health Status"]
#27 [mh ^"Home Care Services"]
#28 [mh ^"Home Health Nursing"]
#29 [mh ^"House Calls"]
#30 [mh ^"Mass Screening"]
#31 [mh ^"Nurses, Community Health"]
#32 [mh ^"Nursing Assessment"]
#33 [mh ^"Office Visits"]
#34 [mh ^"Primary Health Care"]
#35 [mh ^"Preventive Health Services"]
#36 ((assess* or detect* or diagnos* or evaluat* or exam* or screen* or surveill* or test*) near/5 (family doctor* or "family practi*" or "family physician*" or "general practic*" or GP or "primary care" or "primary health care")):ti,ab,kw
#37 ((assessment* or education or promotion*) near/1 health*):ti,ab,kw
#38 ((care* or service* or support* or visit*) near/2 (communit* or domicil* or home* or out-reach* or outreach*)):ti,ab,kw
#39 (communit* near/3 (out-reach* or outreach* or practice* or program*)):ti,ab,kw
#40 ((clinician* or health or doctor* or nurse* or physician* or volunteer*) near/2 visit*):ti,ab,kw
#41 (early and detect*):ti
#42 "geriatric assessment*":ti,ab,kw
#43 (pre-dispos* or predispos*):ti,ab,kw
#44 {or #20-#43}
#45 (assess* or detect* or diagnostic* or evaluat* or exam* or prevent* or screen* or test*):ti,ab
#46 #44 and #45
#47 #19 or #46
#48 [mh Aged]
#49 [mh ^Geriatrics]
#50 [mh ^"Health Services for the Aged"]
#51 (aged or ageing or aging or elder* or geriatric* or octogenarian* or septuagenarian* or senior*):ti,ab,kw
#52 ((adult* or citizen* or client* or consumer* or female* or male* or men or patient* or

people or person* or wom?n) near/3 older*):ti,ab,kw
#53 [134-#52]#54 {and #47, #53}
#55 ([mh Adolescent] or [mh Child] or [mh Infant]) not [mh Adult]
#56 [mh ^"Adolescent Medicine"]
#57 [mh Pediatrics]
#58 (paediatr* or pediatr*):so
#59 (adolesc* or babies or baby or boy* or child* or fetal or fetus or foet* or girl* or infan* or juvenile* or kid or kids or neo-nat* or neonat* or new-born* or newborn* or paediatr* or pediatr* or preadolesc* or prepubesc* or preteen* or pubescen* or teen* or toddler* or youth*):ti,ab,kw
#60 [135-#59]
#61 #54 not #60
#62 "diabetic retinopath*":ti
#63 #61 not #62
#64 (glaucoma* not (glaucoma* and (AMD or ARMD or cataract* or "macular degeneration*" or vision or visual))):ti
#65 #63 not #64
#66 (optometrist* or ophthalmologist*):ti
#67 #65 not #66
#68 #65 not #66 Publication Year from 2012 to 2016, in Trials

CINAHL Plus with Full Text via EBSCOhost (1937 to the present)

S1. (MM "Accidental Falls/PC")
S2. (MM "Cataract/DI/PC")
S3. (MM "Eye Diseases/DI/PC")
S4. (MM "Macular Degeneration/DI/PC")
S5. (MM "Vision Disorders/DI/PC")
S6. (MH "Vision Screening")
S7. (MH "Vision Tests")
S8. (MH "Visual Acuity/EV")
S9. Amsler
S10. ((AMD or ARMD or cataract* or eye or eyes or "macular degeneration" or ocular or ophthalm* or visual or vision) N3 (assess* or detect* or diagnos* or evaluat* or exam* or prevent* or screen* or test*))
S11. ("E chart*" or "E test*")
S12. ((evaluat* or exam* or test*) N3 ("pin hole" or pinhole))
S13. TI (fall* N2 prevent*)
S14. Jaeger
S15. Landolt*
S16. (Log-Mar* or LogMAR*)
S17. Snellen*
S18. S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17

S19. (MH "Community Health Nursing")
S20. (MH "Community Health Services")
S21. (MH "Community Health Workers")
S22. (MH "Early Diagnosis")
S23. (MH "Family Practice")
S24. (MH "Geriatric Assessment+")
S25. (MH "Health Promotion")
S26. (MH "Health Screening")
S27. (MH "Health Status")
S28. (MH "Home Health Care")
S29. (MH "Home Nursing, Professional")
S30. (MH "Home Visits")
S31. (MH "Nursing Assessment")
S32. (MH "Office Visits")
S33. (MH "Primary Health Care")
S34. (MH "Preventive Health Care")
S35. ((assess* or detect* or diagnos* or evaluat* or exam* or screen* or surveill* or test*) N5 ("family doctor*" or "family practi*" or "family physician*" or "general practic*" or GP or "primary care" or "primary health care"))
S36. ((assessment* or education or promotion*) N1 health*)
S37. ((care* or service* or support* or visit*) N2 (communit* or domicil* or home* or out-reach* or outreach*))
S38. (communit* N3 (out-reach* or outreach* or practice* or program*))
S39. ((clinician* or health or doctor* or nurse* or physician* or volunteer*) N2 visit*)
S40. TI (early and detect*)
S41. "geriatric assessment*"
S42. TI (pre-dispos* or predispos*)
S43. S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42
S44. TI (assess* or detect* or diagnostic* or evaluat* or exam* or prevent* or screen* or test*)
S45. S43 AND S44
S46. S18 OR S45
S47. (MH "Aged+")
S48. (MH "Geriatrics")
S49. (MH "Health Services for the Aged")
S50. (aged or ageing or aging or elder* or geriatric* or octogenarian* or septuagenarian* or senior*)
S51. ((adult* or citizen* or client* or consumer* or female* or male* or men or patient* or people or person* or wom?n) N3 older*)
S52. S47 OR S48 OR S49 OR S50 OR S51
S53. S46 AND S52
S54. (MH "Clinical Trials+")
S55. (MH "Random Assignment")
S56. PT Clinical trial
S57. TX (doubl* N1 (blind* or mask*))

S58. TX (clinic* N1 trial*)
S59. TX (singl* N1 (blind* or mask*))
S60. TX (trebl* N1 (blind* or mask*))
S61. TX (tripl* N1 (blind* or mask*))
S62. TX ("random* allocat*")
S63. TX ("randomi* control* trial*")
S64. S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 [Modified SIGN RCT filter: http://www.sign.ac.uk/methodology/filters.html#random]
S65. ((MH "Vertebrates+") NOT MH Human)
S66. TI (animal or animal-model* or animals or canine* or cat or cats or dog or dogs or feline or felines or hamster or hamsters or mice or monkey or monkeys or mouse or pig or piglet or piglets or pigs or porcine or primate* or rabbit or rabbits or rat or rats or rodent or rodents or sheep or swine or swines)
S67. S64 NOT (S65 OR S66)
S68. S53 AND S67
S69. (((MH "Adolescents+") OR (MH "Child+") OR (MH "Infant+")) NOT (MH "Adult+")
S70. (MH "Adolescent Medicine")
S71. (MH "Pediatrics+")
S72. SO (paediatr* or pediatr*)
S73. (adolesc* or babies or baby or boy* or child* or fetal or fetus or foet* or girl* or infan* or juvenile* or kid or kids or neo-nat* or neonat* or new-born* or newborn* or paediatr* or pediatr* or preadolesc* or prepubesc* or preteen* or pubescen* or teen* or toddler* or youth*)
S74. S69 OR S70 OR S71 OR S72 OR S73
S75. S68 NOT S74
S76. TI (comment * or editor* or letter*)
S77. PT (Commentary or Editorial or Letter)
S78. S75 NOT (S76 OR S77)
S79. PT "Case Study"
S80. TI ("case report*" or "case stud*")
S81. S78 NOT (S79 OR S80)
S82. TI "diabetic retinopath*"
S83. S81 NOT S82
S84. TI (glaucoma* NOT (glaucoma* and (AMD or ARMD or cataract* or macular degeneration* or vision or visual)))
S85. S83 NOT S84
S86. TI (optometrist* or ophthalmologist*)
S87. S85 NOT S86
S88. S85 NOT S86 – Published Date: 20120101-20161231; Language: English, French

Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present

SET 1: Vision Screening – Narrow
"Accidental Falls/prevention and control"[mj:noexp] OR "Eye Diseases/diagnosis"[mj:noexp] OR "Eye Diseases/prevention and control"[mj:noexp] OR "Vision Disorders/diagnosis"[mj:noexp] OR "cataract/diagnosis"[mj:noexp] OR "cataract/prevention and control"[mj:noexp] OR "Eye Diseases/diagnosis"[mj:noexp] OR "Eye Diseases/prevention and

control"[mj:noexp] OR "Macular Degeneration/diagnosis"[mj:noexp] OR "Macular Degeneration/prevention and control"[mj:noexp] OR "Vision Disorders/diagnosis"[mj:noexp] OR "Vision Disorders/prevention and control"[mj:noexp] OR "Vision Screening"[mh:noexp] OR "Vision Tests"[mh:noexp] OR ("Visual Acuity"[mh] AND (assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnose[tiab] OR diagnosed[tiab] OR diagnoses[tiab] OR diagnosing[tiab] OR diagnosis[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab])) OR Amsler[tiab] OR ((AMD[tiab] OR ARMD[tiab] OR cataract[tiab] OR cataracts[tiab] OR eye[tiab] OR eyes[tiab] OR "macular degeneration"[tiab] OR ocular[tiab] OR ophthalmic[tiab] OR ophthalmologic[tiab] OR ophthalmological[tiab] OR visual[tiab] OR vision[tiab]) AND (assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnose[tiab] OR diagnosed[tiab] OR diagnoses[tiab] OR diagnosing[tiab] OR diagnosis[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab])) OR "E chart"[tiab] OR "E charts"[tiab] OR "E test"[tiab] OR "E tests"[tiab] OR ((evaluate[tiab] OR evaluates[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR exams[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]) AND ("pin hole"[tiab] OR pinhole[tiab])) OR ((fall[tiab] OR falls[tiab]) AND (prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab])) OR funduscopic[tiab] OR funduscopy[tiab] OR Jaeger[tiab] OR Landolt[tiab] OR "Log Mar"[tiab] OR LogMAR[tiab] OR Snellen[tiab]

SET 2: Community Screening – Broad
"Community Health Services"[mh:noexp] OR "Community Health Workers"[mh:noexp] OR "Early Diagnosis"[mh:noexp] OR "Family Practice"[mh:noexp] OR "Geriatric Assessment"[mh:noexp] OR "Health Promotion"[mh:noexp] OR "Health Status"[mh:noexp] OR "Home Care Services"[mh:noexp] OR "Home Health Nursing"[mh:noexp] OR "House Calls"[mh:noexp] OR "Mass Screening"[mh:noexp] OR "Nurses, Community Health"[mh:noexp] OR "Nursing Assessment"[mh:noexp] OR "Office Visits"[mh:noexp] OR "Primary Health Care"[mh:noexp] OR "Preventive Health Services"[mh:noexp] OR ((assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnostic[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR

screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]) AND ("family doctor"[tiab] OR "family doctors"[tiab] OR "family practice"[tiab] OR "family physician"[tiab] OR "family physicians"[tiab] OR "general practice"[tiab] OR "general practitioner"[tiab] OR "general practitioners"[tiab] OR GP[tiab] OR "primary care"[tiab] OR "primary health care"[tiab] OR "primary healthcare"[tiab])) OR "community care"[tiab] OR "community out reach"[tiab] OR "community outreach"[tiab] OR "community practice"[tiab] OR "community program"[tiab] OR "community programs"[tiab] OR "community services"[tiab] OR "community support"[tiab] OR (early[ti] AND (detect[ti] OR detected[ti] OR detecting[ti] OR detection[ti] OR detects[ti])) OR "geriatric assessment"[tiab] OR "geriatric assessments"[tiab] OR "health assessment"[tiab] OR "health assessments"[tiab] OR "health education"[tiab] OR "health promotion"[tiab] OR "home care"[tiab] OR "home support"[tiab] OR "home visit"[tiab] OR "home visits"[tiab] OR "pre disposed"[ti] OR "pre disposition"[ti] OR predisposed[ti] OR predisposition[ti]

SET 3: Text words to narrow broad screening set
assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnostic[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR preventing[tiab] OR prevention[tiab] or prevents[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]

SET 4: Text word filter on broad screening results
#2 AND #3

SET 5: Combined concepts for vision and community-based screening
#1 OR #4

SET 6: Older adults
"aged"[MeSH Terms] OR "geriatrics"[MeSH Terms:noexp] OR "Health Services for the Aged"[mh:noexp] OR aged[tiab] OR ageing[tiab] OR aging[tiab] OR elder[tiab] OR elders[tiab] OR geriatric[tiab] OR geriatrics[tiab] OR octogenarian[tiab] OR octogenarians[tiab] OR "older adult"[tiab] OR "older adults"[tiab] OR "older clients"[tiab] OR "older consumers"[tiab] OR "older females"[tiab] OR "older males"[tiab] OR "older patients"[tiab] OR "older persons"[tiab] OR "older people"[tiab] OR septuagenarian[tiab] OR septuagenarians[tiab] OR senior[tiab] OR seniors[tiab]

Set 7: Combined concepts for screening and older adults
#5 AND #6

SET 8: Modified Cochrane highly sensitive RCT filter: sensitivity and precision maximizing version
"clinical trials as topic"[mh:noexp] OR "controlled clinical trial"[pt] OR "randomized controlled trial"[pt] OR placebo[tiab] OR randomised[tiab] OR randomized[tiab] OR randomly[tiab] OR

trial[ti]

Set 9: RCT filter appled to screening and older adults
#7 AND #8

Set 10: Animal filter
("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) OR animal[ti] OR animals[ti] OR canine[ti] OR cat[ti] OR cats[ti] OR dog[ti] OR dogs[ti] OR feline[ti] OR felines[ti] OR hamster[ti] OR hamsters[ti] OR mice[ti] OR monkey[ti] OR monkeys[ti] OR mouse[ti] OR pig[ti] OR piglet[ti] OR piglets[ti] OR pigs[ti] OR porcine[ti] OR primate[ti] OR primates[ti] OR rabbit[ti] OR rabbits[ti] OR rat[ti] OR rats[ti] OR rodent[ti] OR rodents[ti] OR sheep[ti] OR swine[ti] OR swines[ti]

Set 11: Animal filter applied to combined results
#9 NOT #10

SET 12: Child filter
(("adolescent"[MeSH Terms] OR "child"[MeSH Terms] OR "infant"[MeSH Terms]) NOT "adult"[MeSH Terms]) OR "Adolescent Medicine"[mh] OR "pediatrics"[MeSH Terms] OR adolescence[tiab] OR adolescent[tiab] OR adolescents[tiab] OR baby[tiab] OR babies[tiab] OR child[tiab] OR childhood[tiab] OR children[tiab] OR childrens[tiab] OR childs[tiab] OR infancy[tiab] OR infant[tiab] OR infants[tiab] OR neonatal[tiab] OR neonatology[tiab] OR neonate[tiab] OR neonates[tiab] OR "new born"[tiab] OR "new borns"[tiab] OR newborn[tiab] OR newborns[tiab] OR paediatric[tiab] OR paediatrician[tiab] OR paediatricians[tiab] OR peadiatric[tiab] OR peadiatricians[tiab] OR pediatric[tiab] OR pediatrician[tiab] OR pediatricians[tiab] OR "pre mature"[tiab] OR premature[tiab] OR "pre term"[tiab] OR preterm[tiab] OR preschool[tiab] OR preschooler[tiab] OR preschoolers[tiab] OR prepubescence[tiab] OR prepubescent[tiab] OR prepubescents[tiab] OR teen[tiab] OR teenaged[tiab] OR teenager[tiab] OR teenagers[tiab] OR teens[tiab] OR toddler[tiab] OR toddlers[tiab] OR youth[tiab] OR youths[tiab]

SET 13: Child filter applied to combined results
#11 NOT #12

SET 14: Opinion piece filter
comment[pt] OR editorial[pt] OR (letter[pt] NOT (letter[pt] AND "randomized controlled trial"[pt])) OR news[pt] OR "newspaper article"[pt]

SET 15: Opinion piece filter applied to combined results
#13 NOT #14

SET 16: Case reports filter
"case reports"[pt] OR "case report"[ti] OR "case reports"[ti] OR "case study"[ti] OR "case studies"[ti]

SET 17: Case reports filters applied to combined results

#15 NOT #16

SET 18: Diabetic retinopathy filter
"diabetic retinopathies"[ti] OR "diabetic retinopathy"[ti]

SET 19: Diabetic retinopathy filter applied to combined results
#17 NOT #18

SET 20: Glaucoma filter
(glaucoma[ti] OR glaucomas[ti]) NOT ((glaucoma[ti] OR glaucomas[ti]) AND (AMD[ti] OR ARMD[ti] OR cataract[ti] OR cataracts[ti] OR "macular degeneration"[ti] OR vision[ti] OR visual[ti]))

SET 21: Glaucoma filter applied to combined results
#19 NOT #20

SET 22: Specialist filter
optometrist[ti] or optometrists[ti] or ophthalmologist[ti] or ophthalmologists[ti]

SET 23: Specialist filter applied to combined results
#21 NOT #22

SET 24: Language limits
#21 NOT #22 Filters: English; French

SET 25: Electronic Publications filter
(publisher[sb] NOT pubstatusnihms NOT pubstatuspmcsd NOT pmcbook) OR (pubstatusaheadofprint)

SET 26: Electronic Publications filter applied to final results
#24 AND #25

PubMed search on one line:
((((((((((("Accidental Falls/prevention and control"[mj:noexp] OR "Eye Diseases/diagnosis"[mj:noexp] OR "Eye Diseases/prevention and control"[mj:noexp] OR "Vision Disorders/diagnosis"[mj:noexp] OR "cataract/diagnosis"[mj:noexp] OR "cataract/prevention and control"[mj:noexp] OR "Eye Diseases/diagnosis"[mj:noexp] OR "Eye Diseases/prevention and control"[mj:noexp] OR "Macular Degeneration/diagnosis"[mj:noexp] OR "Macular Degeneration/prevention and control"[mj:noexp] OR "Vision Disorders/diagnosis"[mj:noexp] OR "Vision Disorders/prevention and control"[mj:noexp] OR "Vision Screening"[mh:noexp] OR "Vision Tests"[mh:noexp] OR ("Visual Acuity"[mh] AND (assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnose[tiab] OR diagnosed[tiab] OR diagnoses[tiab] OR diagnosing[tiab] OR diagnosis[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR

examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab])) OR Amsler[tiab] OR ((AMD[tiab] OR ARMD[tiab] OR cataract[tiab] OR cataracts[tiab] OR eye[tiab] OR eyes[tiab] OR "macular degeneration"[tiab] OR ocular[tiab] OR ophthalmic[tiab] OR ophthalmologic[tiab] OR ophthalmological[tiab] OR visual[tiab] OR vision[tiab]) AND (assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnose[tiab] OR diagnosed[tiab] OR diagnoses[tiab] OR diagnosing[tiab] OR diagnosis[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab])) OR "E chart"[tiab] OR "E charts"[tiab] OR "E test"[tiab] OR "E tests"[tiab] OR ((evaluate[tiab] OR evaluates[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR exams[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]) AND ("pin hole"[tiab] OR pinhole[tiab])) OR ((fall[tiab] OR falls[tiab]) AND (prevent[tiab] OR prevented[tiab] OR prevents[tiab] OR preventing[tiab] OR prevention[tiab])) OR funduscopic[tiab] OR funduscopy[tiab] OR Jaeger[tiab] OR Landolt[tiab] OR "Log Mar"[tiab] OR LogMAR[tiab] OR Snellen[tiab]) OR (("Community Health Services"[mh:noexp] OR "Community Health Workers"[mh:noexp] OR "Early Diagnosis"[mh:noexp] OR "Family Practice"[mh:noexp] OR "Geriatric Assessment"[mh:noexp] OR "Health Promotion"[mh:noexp] OR "Health Status"[mh:noexp] OR "Home Care Services"[mh:noexp] OR "Home Health Nursing"[mh:noexp] OR "House Calls"[mh:noexp] OR "Mass Screening"[mh:noexp] OR "Nurses, Community Health"[mh:noexp] OR "Nursing Assessment"[mh:noexp] OR "Office Visits"[mh:noexp] OR "Primary Health Care"[mh:noexp] OR "Preventive Health Services"[mh:noexp] OR ((assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnostic[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR preventing[tiab] OR prevention[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]) AND ("family doctor"[tiab] OR "family doctors"[tiab] OR "family practice"[tiab] OR "family physician"[tiab] OR "family physicians"[tiab] OR "general practice"[tiab] OR "general practitioner"[tiab] OR "general practitioners"[tiab] OR GP[tiab] OR "primary care"[tiab] OR "primary health care"[tiab] OR "primary healthcare"[tiab])) OR "community care"[tiab] OR "community out reach"[tiab] OR "community outreach"[tiab] OR "community practice"[tiab] OR "community program"[tiab] OR "community programs"[tiab] OR "community services"[tiab] OR "community support"[tiab] OR (early[ti] AND (detect[ti] OR detected[ti] OR detecting[ti] OR detection[ti] OR detects[ti])) OR "geriatric assessment"[tiab] OR "geriatric assessments"[tiab] OR "health assessment"[tiab] OR "health assessments"[tiab] OR "health education"[tiab] OR "health promotion"[tiab] OR "home care"[tiab] OR "home support"[tiab]

OR "home visit"[tiab] OR "home visits"[tiab] OR "pre disposed"[ti] OR "pre disposition"[ti] OR predisposed[ti] OR predisposition[ti]) AND (assess[tiab] OR assessed[tiab] OR assesses[tiab] OR assessing[tiab] OR assessment[tiab] OR assessments[tiab] OR detect[tiab] OR detected[tiab] OR detection[tiab] OR detecting[tiab] OR detects[tiab] OR diagnostic[tiab] OR evaluate[tiab] OR evaluated[tiab] OR evaluation[tiab] OR evaluations[tiab] OR evaluating[tiab] OR exam[tiab] OR examinate[tiab] OR examinated[tiab] OR examination[tiab] OR examinations[tiab] OR exams[tiab] OR prevent[tiab] OR prevented[tiab] OR preventing[tiab] OR prevention[tiab] OR prevents[tiab] OR screen[tiab] OR screened[tiab] OR screening[tiab] OR screens[tiab] OR test[tiab] OR tested[tiab] OR testing[tiab] OR tests[tiab]))) AND ("aged"[MeSH Terms] OR "geriatrics"[MeSH Terms:noexp] OR "Health Services for the Aged"[mh:noexp] OR aged[tiab] OR ageing[tiab] OR aging[tiab] OR elder[tiab] OR elders[tiab] OR geriatric[tiab] OR geriatrics[tiab] OR octogenarian[tiab] OR octogenarians[tiab] OR "older adult"[tiab] OR "older adults"[tiab] OR "older clients"[tiab] OR "older consumers"[tiab] OR "older females"[tiab] OR "older males"[tiab] OR "older patients"[tiab] OR "older persons"[tiab] OR "older people"[tiab] OR septuagenarian[tiab] OR septuagenarians[tiab] OR senior[tiab] OR seniors[tiab])) AND ("clinical trials as topic"[mh:noexp] OR "controlled clinical trial"[pt] OR "randomized controlled trial"[pt] OR placebo[tiab] OR randomised[tiab] OR randomized[tiab] OR randomly[tiab] OR trial[ti])) NOT (("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) OR animal[ti] OR animals[ti] OR canine[ti] OR cat[ti] OR cats[ti] OR dog[ti] OR dogs[ti] OR feline[ti] OR felines[ti] OR hamster[ti] OR hamsters[ti] OR mice[ti] OR monkey[ti] OR monkeys[ti] OR mouse[ti] OR pig[ti] OR piglet[ti] OR piglets[ti] OR pigs[ti] OR porcine[ti] OR primate[ti] OR primates[ti] OR rabbit[ti] OR rabbits[ti] OR rat[ti] OR rats[ti] OR rodent[ti] OR rodents[ti] OR sheep[ti] OR swine[ti] OR swines[ti])) NOT ((("adolescent"[MeSH Terms] OR "child"[MeSH Terms] OR "infant"[MeSH Terms]) NOT "adult"[MeSH Terms]) OR "Adolescent Medicine"[mh] OR "pediatrics"[MeSH Terms] OR adolescence[tiab] OR adolescent[tiab] OR adolescents[tiab] OR baby[tiab] OR babies[tiab] OR child[tiab] OR childhood[tiab] OR children[tiab] OR childrens[tiab] OR childs[tiab] OR infancy[tiab] OR infant[tiab] OR infants[tiab] OR neonatal[tiab] OR neonatology[tiab] OR neonate[tiab] OR neonates[tiab] OR "new born"[tiab] OR "new borns"[tiab] OR newborn[tiab] OR newborns[tiab] OR paediatric[tiab] OR paediatrician[tiab] OR paediatricians[tiab] OR peadiatric[tiab] OR peadiatricians[tiab] OR pediatric[tiab] OR pediatrician[tiab] OR pediatricians[tiab] OR "pre mature"[tiab] OR premature[tiab] OR "pre term"[tiab] OR preterm[tiab] OR preschool[tiab] OR preschooler[tiab] OR preschoolers[tiab] OR prepubescence[tiab] OR prepubescent[tiab] OR prepubescents[tiab] OR teen[tiab] OR teenaged[tiab] OR teenager[tiab] OR teenagers[tiab] OR teens[tiab] OR toddler[tiab] OR toddlers[tiab] OR youth[tiab] OR youths[tiab])) NOT (comment[pt] OR editorial[pt] OR (letter[pt] NOT (letter[pt] AND "randomized controlled trial"[pt])) OR news[pt] OR "newspaper article"[pt])) NOT ("case reports"[pt] OR "case report"[ti] OR "case reports"[ti] OR "case study"[ti] OR "case studies"[ti])) NOT ("diabetic retinopathies"[ti] OR "diabetic retinopathy"[ti])) NOT ((glaucoma[ti] OR glaucomas[ti]) NOT ((glaucoma[ti] OR glaucomas[ti]) AND (AMD[ti] OR ARMD[ti] OR cataract[ti] OR cataracts[ti] OR "macular degeneration"[ti] OR vision[ti] OR visual[ti])))) NOT (optometrist[ti] OR optometrists[ti] OR ophthalmologist[ti] OR ophthalmologists[ti]) AND ((English[lang] OR French[lang]))) AND ((publisher[sb] NOT pubstatusnihms NOT pubstatuspmcsd NOT pmcbook) OR (pubstatusaheadofprint))

APPENDIX C: Systematic Reviews Examined for Studies

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APPENDIX D: List of Excluded Studies

Language

1. Dam VH, Bleijenberg N, Numans ME, et al. [Proactive and structured care for the elderly in primary care]. Tijdschrift voor gerontologie en geriatrie; 2013. p. 81-9.

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Study Design

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No outcome data available (as per author)

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APPENDIX E: Study Characteristics

Haanes 2015[1]	
Objective	To evaluate the changes in vision, hearing, and lighting conditions at home following a clinical intervention.
Methods	Design: RCT Country: Norway Study period: September 2011-February 2012 Inclusion criteria: 80 yrs and over, receiving home care, able to speak Norwegian Exclusion criteria: dementia, cognitive impairment, very serious illness
Participants	Recruitment: home care lists Sample: Intervention (n=46); Control (n=47) Mean age (SD): Intervention=88 (NR); Control=88 (NR) Race/ethnicity: NR Females (%): Intervention=83; Controls=72 Falls (%): NR Lives alone (%): Intervention=72; Controls=70 Education (%): Intervention= 72; Controls=64 (Elementary only) Income (%): Intervention=26; Controls=30 (Difficult financial status) Urban (%): NR, 4 rural and 1 borough municipalities (all maximum 1hr drive to specialist) Diabetes (%): NR Dementia (%): exclusion criteria

	Residing in nursing homes (%): Intervention= 0; Controls=0 (receiving home care) Baseline vision loss (%): 95% logMAR ≤0.8 (at least slight VI); 39.8% logMAR <0.4 (<20/50); 17% had difficulties ADLs/IALDs because of hearing or vision, 21% could not read regular newsprint (all participants) Other disorders of vision (%): NR Length of follow-up: 2.5 mo; loss to follow-up: Intervention= 5 (11%), Control= 8 (17%)
Interventions	Intervention: Vision screening: 1) measured visual acuity and 2) self-reported vision problems Tool & administration of screening test: 1) Bailey-Lovie LogMAR distance VA chart at 6m presenting with spectacles and 2) KAS-Screen instrument with 16 questions on hearing and vision and 1 global question "Do you consider your vision to be good, not so good, poor or very poor/deaf/blind?"; trained home care nurses Care in response to screening test: Home care nurses gave advice and referred to specialists if VA ≤0.7 logMAR and not currently treated. Setting of program: home Number of interactions after screening & duration of intervention: 9; 2.5 mo Other components of screening/assessment: hearing tests and assessment of home lighting conditions with interventions for both Other components of care potentially impacting vision: assessment and correction of lighting condition in homes; assistance with booking medical appointments Control: Usual care from home care nurses; same vision assessment at baseline
Outcomes	Benefits: Mean change in acuity: Bailey-Lovie LogMAR distance VA chart Harms: NR Implementation factors: Referrals/recommendations provided to those eligible Uptake of referrals
Notes	Data sources: Published paper and dissertation provided by author. Most participants wore ready-made spectacles; only 6% daily.

Dapp 2011[2]	
Objective	To evaluate the feasibility and acceptance of the Health Risk Assessment for Older Persons (HRA-O) instrument combined with physician training and with group sessions or preventive home visits, and to determine the short-term effects of this multifaceted intervention on preventive care use and health behavior in older persons.
Methods	Design: RCT Country: Germany Study period: 2000-2002

	Inclusion criteria: 60 years and older (country's age for elderly care) Exclusion criteria: those with need for human help in basic ADLs and/or receiving nursing care, cognitive impairment, terminal disease and/or inability to understand German
Participants	Recruitment: 14 GP offices in metropolitan area of Hamburg (7 additional used for concurrent comparison group); practitioners matched for age, gender, qualifications Sample: Intervention (n=878); Control (n=1702) Mean age (SD): Intervention=71.9 (7.7); Control=71.8 (7.6) Race/ethnicity: NR Females (%): Intervention=61.5; Control=63.3 Falls (%): NR Lives alone (%): Intervention=35; Control=37.4 Education (%): Intervention=18.8; Control=23.5 (low level) Income (%): NR Urban (%): metropolitan region Diabetes (%): Intervention=9.4; Control=10.7 Dementia (%): exclusion criteria Residing in nursing homes (%): exclusion criteria Baseline vision loss: NR Other disorders of vision (%): NR Length of follow-up: 12 mo for vision outcomes; loss to follow-up: Intervention=29.4%, Control=16.2% at 12 mo (37% and 24% for vision outcome; 35% and 21% for vision check-ups) (1.5% deaths)
Interventions	Intervention: Vision screening: 1) self-reported vision problems Tool & administration of screening test: 1) 11 self-reported vision questions (e.g. near and far vision, contrast sensitivity) selected from VFQ-25 including overall question "At the present time, would you say your eyesight using both eyes (*with your glasses or contact lenses, if you wear them*) is excellent/good/fair/poor/very poor/completely blind?" (if excellent no further questioning); self-administered via mailed by participants Care in response to screening test: participants received personalized feedback report and GPs received summary report (both computer-generated); includes individually tailored information and recommendations based on the older persons' responses to the questionnaire (including vision check-ups), general health information on each domain addressed in the HRA-O questionnaire, and sources of further information in the community; GPs provided manual with evidence-based guidelines; other healthcare professionals involved in reinforcement sessions Setting of program: Home (self-administered screening & 2 home visits providing reinforcement for some [n=77]), GP offices (routine visits for all), and geriatric centres for an interdisciplinary group visit for reinforcement (n=503) Number of interactions after screening & duration of intervention: routine visits with GPs + 1-2 reinforcements sessions; up to 1 year

	Other components of screening/assessment: HRA-O is multidimensional Other components of care potentially impacting vision: one 4-hr group, empowerment-based structured interdisciplinary session (n=503) or two preventive home visits from nurse with additional vision assessment (n=77); all GPs for both groups received training at baseline and bimonthly in risk assessment and health promotion Control: Usual care by same trained GPs; vision assessed via HRA-O only at 1-year followup
Outcomes	Benefits: Self-reported vision problems: based on 9 HRA-O select vision questions from VHQ-25 (proportion with ≥1 sub-domain having moderate or greater difficulty) Harms: NR Implementation factors: Eye care professional visits: self-reported vision check-up in previous year
Notes	Data from study publication, published protocol, and author contact (clarifying definition of outcome). This study also incorporated a comparison group (not randomized) which was not considered for this systematic review.

Harari 2008[3]	
Objective	To evaluate the effect of using the Health Risk Appraisal for Older Persons (HRA-O) on health behavior and preventative-care uptake in older, functionally independent, people in NHS primary care.
Methods	Design: RCT Country: London, UK Study period: April 2001-April 2002 Inclusion criteria: 65 yrs and over Exclusion criteria: nursing home resident, needing help in basic ADLs, dementia, terminal disease, and non-English speaking
Participants	Recruitment: registered patients of 18 GPs Sample: Intervention (n=1240); Control (n=1263) Mean age (SD): Intervention= 74.7(6.4); Control= 74.4(6.2) Race/ethnicity: NR (all English-speaking) Females (%): Intervention= 55.3; Controls= 54.6 Falls (%): NR Lives alone (%): NR Education (%): NR Income (%): wide diversity of social classes Urban (%): urban residential areas Diabetes (%): Intervention= 7.7; Controls=7.2

	Dementia (%): exclusion criteria Residing in nursing homes (%): exclusion criteria Baseline vision loss: Intervention: 21.4% (Fair, poor or very poor vision); Control: Not collected Other disorders of vision (%): NR Length of follow-up:12 months; loss to follow-up (return of HRA-O questionnaire at 1 yr): Intervention=300 (24%), Control=197 (16%)
Interventions	Intervention: Vision screening: 1) self-reported vision problems Tool & administration of screening test: 1) 11 self-reported vision questions (e.g. near and far vision, contrast sensitivity) selected from VFQ-25 including overall question "At the present time, would you say your eyesight using both eyes (*with your glasses or contact lenses, if you wear them*) is excellent/good/fair/poor/very poor/completely blind?" (if excellent overall vision no other questions asked); self-administered via mailed by participants Care in response to screening test: Patients given feedback (20-35 page report) about their results, information on each domain assessed in HRA-O and on other services in community, and a personalized preventative health checklist. They were given a letter encouraging followup with their GP or practice nurse and a reminder at 6 mo. GPs provided with 1-page summary report (scanned into IT system) and chose which items to integrate into the electronic patient record with prompts; GPs also provided manual with evidence-based guidance for preventive practices. No reinforcement or dedicated professional time. Setting of program: home (computer-generated feedback) and GP offices during routine visits Number of interactions after screening & duration of intervention: variable based on routine visits; reminders sent after 6 mo to patients not contacting GPs Other components of screening: HRA-O questionnaire measures 21 domains, including medical history, health measurements, medications, pain, oral health, hearing, nutrition, injury prevention, tobacco and alcohol use and social network. Other components of care potentially impacting vision: All GPs and practice nurses for both groups received training at baseline and bimonthly in risk assessment and health promotion. Control: Usual care by same trained GPs; vision assessed via HRA-O only at 1-year followup
Outcomes	Benefits: Self-reported vision problems: based on 9 HRA-O select vision questions from VHQ-25 (proportion with ≥1 sub-domain having moderate or greater difficulty)

	Harms: NR Implementation factors: Eye professional visits: self-reported vision check-ups in previous yr
Notes	Data from study publication, published protocol, and author contact. Results are from analysis of individual patient data provided by authors. This study also incorporated a comparison group (not randomized) which was not considered for this systematic review.

Tay 2006[4]	
Objective	To assess the need for, and the use of eye care services in older people seeking aged care.
Methods	Design: RCT Country: Australia Study period: 2003-2004 Inclusion criteria: 65 years or older, English speaking, living at home, being assessed for aged care provision Exclusion criteria: profound dementia
Participants	Recruitment: approached clients attending aged care assessment services at Westmead Hospital, Sydney, serving residents living in three local government areas with an estimated population of almost 400 000 Sample: Intervention (n=96); Control (n=92) Mean age (SD): 82 (6) in final sample (15% ≤74 yrs; 34% ≥85 yrs) Race/ethnicity: NR Females (%): 64 (in final sample) Falls (%): 55 (last 12 months) Lives alone (%): 34 (in final sample) Education (%): NR Income (%): NR Urban (%): NR Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): exclusion criteria (all being assessed for aged care) but 41% receiving health services such as home care Baseline vision loss: Intervention: 31% bilateral & 29% unilateral visual impairment Other disorders of vision (%): NR Length of follow-up: 12 mos; loss to follow-up: 67 (36%; 30% in survivor group); NR by group
Interventions	Factorial 2x2 with vision, hearing, vision and hearing, no testing (self-report

	screening only groups Intervention: Vision screening: measured distance and near visual acuity (with pinhole correction) and visual field; self-reported vision problems Tool & administration of screening test: presenting distance visual acuity (VectorVision logMAR chart), binocular near vision and visual field using confrontation method, pinhole testing if presenting acuity <6/6; Are you able to recognize a friend across the street?; Can you read ordinary print in the newspaper reasonably well, with your glasses? Care in response to screening test: Only vision tests (not self-report) led to referrals. People with under-corrected refractive error (pinhole VA improved at least 10 letters/2 lines in those with presenting VA <6/6), bilateral visual impairment (better eye VA <6/12), or having suspected visual field defects were recommended to have further assessment by eye care professionals. Setting of program: home visits or day hospital Number of interactions after screening: 0 Other components of screening/assessment: hearing for half, multicomponent aged care assessments Other components of intervention potentially impacting vision: no obvious Control: No vision testing/measurement; self-reported vision assessed during routine aged care assessment and interview using a standardized questionnaire (10% referred to eye care professionals)
Outcomes	Benefits: Impaired visual acuity: distance high contrast VA (numbers of letters) Impaired visual acuity: proportion with bilateral visual impairment (presenting acuity <6/12 in the better eye) Harms: NR Implementation factors: Referrals provided Uptake of referrals
Notes	Data from published paper with confirmation of interventions and results by author.

Lord 2005[5]	
Objective	To determine whether an individualized falls prevention program comprising exercise, visual, and counseling interventions can reduce physiological falls risk and falls in older people at some risk for falls.
Methods	Design: RCT Country: Australia Study period: NR Inclusion criteria: community-dwelling people aged 75 and older, living in northern Sydney, Australia, at some risk for falls via physiological profile assessment (PPA;

	9% consenting people excluded for this). Exclusion criteria: minimal English language skills, blind, Parkinson's disease, or a Short Portable Mental Status Questionnaire score less than 7.
Participants	Recruitment: drawn from a health insurance company membership database. Sample: Extensive Intervention (n=210); Minimal Intervention Group (n=206); Control (n=204) Mean age (SD): Extensive Intervention=80.3 (4.3); Minimal Intervention Group=80.7 (4.6); Control= 80.2 (4.6) Race/ethnicity: NR Females (%): Extensive Intervention=66.7; Minimal Intervention Group=62.1; Controls= 69.1 Falls (%): Extensive Intervention=33.3; Minimal Intervention Group=26.2; Controls=29.4 (fall in last year; difference between groups for fear of falling) Lives alone (%): NR Education (%): NR Income (%): NR Urban (%): NR Diabetes (%): Extensive Intervention= 7.6; Minimal Intervention Group=5.8; Controls=7.8 Dementia (%): exclusion criteria Residing in nursing homes (%): exclusion criteria Baseline vision loss: (to come after analysis) Other disorders of vision (%): NR Length of follow-up: 6 months for vision outcomes; loss to follow-up: Extensive Intervention=41 (19.5%), Minimal Intervention Group=35 (17%); Control=26 (12.7%)
Interventions	Extensive Intervention: Vision screening: measured visual acuity and other vision loss Tool & administration of screening test: presenting high and low contrast visual acuity assessed with logMAR chart at 3m, edge-contrast sensitivity was assessed with the Melbourne Edge Test and depth perception with the Howard-Dohlman apparatus; administered by investigators Care in response to screening test: Participants received risk assessment report including written recommendations. If subjects had one or more PPA vision standardized test scores less than -1 they received interventions for maximizing vision, including referral to an eye specialist, change in spectacles and cataract surgery. Referral also if no eye examination in 6mos. Advice regarding wearing multifocal glasses at home only. Setting of program: falls assessment clinic Number of interactions after screening & duration of intervention: counselling session after the assessment (may have also received twice weekly exercise classes) Other components of screening/assessment: Physiological Profile Assessment which includes lower limb sensation, strength of muscles, reaction time, and body

	sway; Short-Form 12 Health Status Questionnaire Other components of care potentially impacting vision: counselling regarding medications and other medical conditions. Minimal Intervention: Same screening tool and setting. Received a report outlining their falls risk, a profile of their test results and specific recommendations for preventing falls. They received brief advice about how to maximize their vision. No referrals or counselling session. Control: No intervention; baseline vision assessment. At the end of 12 months they received a report outlining their falls risk, a profile of test results and recommendations for preventing falls.
Outcomes	Benefits: Impaired visual acuity: mean change in visual acuity: high contrast distance visual acuity, proportion with minimally important difference (0.1 logMAR change for worse and better) in visual acuity Harms: NR Implementation factors: NR
Notes	Data from published report and author contact. Results based on analysis of individual patient data provided by author. Each intervention group is compared with the control group for analysis, with adjustment for sample size in the control group.

Smeeth 2003[6]	
Objective	To determine the effectiveness of screening for visual impairment in people aged 75 or over as part of a multidimensional screening programme.
Methods	Design: RCT cluster, 2x2 factorial for 1) universal vs targeted assessment, and 2) multidisciplinary geriatric vs. usual primary care management Country: United Kingdom Study period: 1995 to 1999 Inclusion criteria: 75 years or over, registered with participating general practices Exclusion criteria: resident in a long stay hospital, nursing home, terminally ill
Participants	Recruitment: random sample of 4340 participants from 20 general practices; part of larger RCT of 106 general practices Sample: Universal screening (n=2140); Targeted screening (n=2200) Mean age (SD): Universal =80.3 (NR); Targeted =79.9 (NR) Race/ethnicity: NR Females (%): Universal =60.2; Targeted =63.2 Falls (%): Universal =20.4; Targeted =17.7 (at home over past 6 mo) Lives alone (%): NR (45% in larger trial sample) Education (%): NR Income (%): NR (clusters stratified for Jarman index of underprivileged areas) Urban (%): NR Diabetes (%): NR

	Dementia (%): NR Residing in nursing homes (%): exclusion criteria Baseline vision loss (%): Universal: 28.8; Targeted: 43 (visual acuity <6/18 in either eye); targeted participants only had testing if meeting detailed screening criteria (see below description of control intervention) Other disorders of vision (%): Universal 3; targeted 1 (Blind) Length of follow-up: 36 to 60 mos (median 3.9 yr); loss to follow-up: Universal=1311 (61% [42.1% of those alive]), Targeted=1222 (66% [32.3% of those alive])
Interventions	Intervention (universal screening): Vision screening: measured visual acuity Tool & administration of screening test: visual acuity (logMAR scale using a Glasgow acuity chart) Snellen equivalent acuity, people with VA less than 6/18 in either eye had measurements repeated using a pinhole occlude; administered by trained nurse Care in response to screening test: Referred to ophthalmologist if pinhole vision was less (worse) than 6/18, unless they were registered as blind or had seen an ophthalmologist in the previous year. Participants whose presenting VA was worse than 6/18 but with pinhole testing improved to better than 6/18 (refractive error) were advised to see an optician. Setting of program: GP offices or at home (33.5%) Number of interactions after screening: none Other components of screening/assessment: detailed assessment comprehensive for multiple clinical domains; also received brief assessment that includes vision component Other components of intervention potentially impacting vision: none obvious Control (targeted screening): Brief screening assessment (all participants) that included a question about difficulty seeing newsprint; administered by nurse, office staff or mail. Only people found to have a pre-specified range and level of problems during the brief assessment (3 or more problems or any one of 4 “serious” symptoms; no referral for just vision) were invited to have the detailed assessment including visual acuity and offered referrals as suitable (overall 5.5% had detailed assessments).
Outcomes	Benefits: Vision-related functional limitations: mean composite score of VFQ-25 (range: 100 points; higher scores better) Impaired visual acuity: 1) Proportion with impaired visual acuity (worse than 6/18 in either and both eyes; WHO standards), 2) Proportion with impaired visual acuity (worse than 6/12 in either and both eyes; North American standards) Harms: NR Implementation factors: Referrals/recommendations to those eligible based on screen Uptake of referrals
Notes	Data from publication.

Day 2002[7]	
Objective	To test the effectiveness of, and explore interactions between, three interventions to prevent falls among older people.
Methods	Design: RCT (full factorial 2x2x2 design with 8 groups based on vision, strength and balance, home modifications, and control) Country: Australia Study Period: NR Inclusion criteria: 70 years and older, living in their own home/accommodation Exclusion criteria: participated in moderate physical activity with balance component in last 2 mo; could not walk 10-20 meters without rest, angina, or help; severe respiratory or cardiac disease; psychiatric illness prohibiting participation; dysphasia; recent major home modifications; education or language score > 4 on short portable mental status questionnaire; no approval from GP
Participants	Recruitment: registered on Australian electoral roll (96% eligible voters registered) Sample: For vision outcomes (n=442 randomly selected for vision assessment of 971 completing from 1090 enrolled): vision alone (n=51); all those receiving vision intervention (n=206); no intervention (n=47); all receiving no vision intervention (n=236) For falls outcomes (n=1090): vision alone (n=139); all those receiving vision intervention (n=547); no intervention (n=137); all receiving no vision intervention (n=543) Mean age (SD): 76.1 (5.0): 46% 70-74, 7.3% over 85 (all participants) Race/ethnicity (%) White: NR Females (%): 59.8 Falls (%): 6.3 in past month Lives alone (%): 54% Education (%): NR Income (%): NR Urban (%): urban community of Melbourne Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): exclusion criteria Baseline vision: high contrast VA in best eye: 0.08 (0.19) logMAR; low contrast in best eye 0.38 (0.19) logMAR Other disorders of vision (%): NR Length of follow-up: up to 18 mo; loss to follow-up: for vision, only those completing [89%] with baseline variables similar to all participants; for falls 11% overall withdrew but similar total person-years across groups (range: 167-188 person yrs)
Interventions	Factorial design of 3 possible interventions with vision: vision, vision + strength and balance (1-hour class for 15 weeks), vision + home hazards (removal or modification

	of hazards), and 3 without (no intervention, strength and balance, home hazards) Intervention (vision intervention): Vision screening: structured measurement of visual acuity and other vision problems Tool & administration of screening test: dual (high and low contrast) visual acuity (Verbaken chart; with glasses 2m from chart), stereopsis (random dot stereo butterfly test and crossed disparity circles), and field of view (OKP glaucoma screening test); administered by trained assessor Care in response to screening test: If a participant's vision tested below predetermined criteria and if he or she was not already receiving treatment for the problem identified, the participant was referred to his or her usual eye care provider, GP, or local optometrist, to whom the vision assessment results were given. Setting of program: home Number of interactions after screening: vision only group: none except for those referred to eye professional or GP; other groups receiving vision (up to 15 if in strength and balance) Other components of screening/assessment: vision only group: none; other groups receiving vision: strength and balance and home hazards Control: No intervention until after study; vision assessment at baseline; all 4 groups not allocated to vision screening received Australian Optometrist Association's brochure on eye care for those aged over 40.
Outcomes	Benefits: Falls: risk of falls requiring medical attention (sought medical care or attended hospital); reported using monthly calendar system to record daily falls, with follow up if not submitting or if reporting fall. Results using main effects factorial model for all 3 groups receiving vision (no interaction effects found); further analysis using negative binomial regression for singular and additive average effects of intervention vs. not receiving intervention. Impaired visual acuity: mean change in logMAR for high contrast visual acuity Harms: NR Implementation factors: Referrals for those eligible Uptake of referrals
Notes	Data from original (via online version) and subsequent published paper, and author contact for additional information on results (no additional vision results available) and screening tool.

Newbury 2001[8]	
Objective	To measure the outcomes of a health assessment, conducted by a nurse, of people aged 75 years and older (75+HA) living independently in their own homes.
Methods	Design: RCT Country: Australia Study Period: August 1998 – February 1999

	Inclusion criteria: 75 years and older, living independently in the community Exclusion criteria: residing in a nursing home, suffering from dementia, unable to consent to the study
Participants	Recruitment: 6 general practices in a suburban area, with random sample of every 20th patient in register assessed for eligibility and invited via letter and follow-up telephone call Sample: Intervention (n=50); Control (n=50) Mean age (SD): Intervention=78.96 (3.49); Control=80.76 (3.76) Race/ethnicity: NR Females (%): Intervention=60; Control=66 Falls (%): Intervention= 45; Control= 38.6 Lives alone (%): NR Education (%): NR Income (%): NR Urban (%): suburb of Adelaide Diabetes (%): NR Dementia (%): exclusion criteria Residing in nursing homes (%): exclusion criteria Other disorders of vision (%): Intervention= Glaucoma 14%, cataract 32%, macular degeneration 2%, other 14% (but all at year 2 reduced so thought error); Control= Glaucoma 10%, cataract 16%, macular degeneration 2%, other 2% Length of follow-up: 12 months; loss to follow-up: Intervention=5 (10%); Control=6 (8.5%)
Interventions	Intervention: Vision screening: 2 self-report questions within 75+HA tool Tool & administration of screening test: "Do you have any difficulty in seeing newsprint, even when you are wearing your glasses?"; self-assessed vision as very good, good, fair, poor or blind; self-reporting of visual pathology (Cataracts, macular degeneration, diabetic retinopathy etc) and driving; administered by nurse Care in response to screening test: Results sent to nominated GP right after assessment. Setting of program: home visit for screening and GP encounters for follow up Number of interactions after screening: only routine visits to GP Other components of screening/assessment: 75+HA assesses 13 domains including hearing, physical condition, medication, compliance, cognition, mood AGL, mobility, nutrition, social and housing and SF-36. Geriatric Depression Scale also administered. Other components of intervention potentially impacting vision: none other than conditions screened Control: Usual care (no home visits and GP blinded); vision assessment via 75+HA at 1 year follow-up.
Outcomes	Benefits:

	Self-reported vision problems: proportion reporting blindness, or fair or poor vision (vs. good or very good) Falls: proportion of falls attributed (methods not reported) to impaired vision Harms: NR Implementation factors: Referrals for those eligible
Notes	Data from published paper and author contact for additional information on screening tool and results via thesis.

Eekhof 2000[9]	
Objective	To assess the effects of GPs' screening of the elderly on four highly prevalent disorders with possibilities for treatment: hearing and visual disorders, urinary incontinence and mobility disorders.
Methods	Design: RCT (cluster of 6 pairs of GPs matched by location, group/solo practice, age, sex, years of practice) Country: Netherlands Study period: NR Inclusion criteria: 75 yrs and older Exclusion criteria: too ill, suffering from dementia or not able to participate for other reasons
Participants	Recruitment: first 160 patients (alphabetical from patient lists) at GP practices Sample: Intervention (n=689); Control (n=679) Mean age (SD): Intervention=81.3 (4.4); Control=81.5 (4.4) Race/ethnicity: NR Females (%): Intervention=64; Controls=68 Falls (%): NR Lives alone (%): NR Education (%): NR Income (%): NR Urban (%): NR Diabetes (%): NR Dementia (%): exclusion criteria Residing in nursing homes (%): exclusion criteria Baseline vision loss (%): 48.7 (43.4-53.9) vision disorder via screening criteria Other disorders of vision (%): NR Length of follow-up: variable (3-12 mo; if no contact by patient in 9 mo they were contacted for screening); loss to follow-up: Intervention=206 (30%), Control=134 (20%)
Interventions	Intervention: Vision screening: self-reporting questions and/or structured measurement of near and far

	visual acuity under usual functioning (e.g. with spectacles if worn) Tool & administration of screening test: having difficulty in recognizing a face at 4 m, and/or reading the normal letters in a newspaper, and/or impaired vision with both eyes (Snellen chart <0.3 [20/40]), or not being able to read normal newspaper letters at 25 cm distance; administered by GPs Care in response to screening test: GP discussed results with the patient; followed new findings with treatment or referrals to specialists (usual care of GPs) Setting of program: GP offices and/or homes Number of interactions after screening & duration of intervention: not specified except frequent visits for some Other components of screening/assessment: screening for hearing, urinary incontinence, mobility disorders Other components of intervention potentially impacting vision outcomes: none Control: Not selected or screened in the first year; screened along with intervention group in the second year.
Outcomes	Benefits: Self-reported vision problems: proportion with disorder in vision via difficulty in recognizing a face at 4 m, and/or reading the normal letters in a newspaper, and/or impaired vision with both eyes (Snellen chart <0.3), or not being able to read normal newspaper letters at 25 cm distance Harms: NR Implementation factors: Referrals/recommendations for those eligible Uptake of referrals (referrals to ophthalmologist or other interventions provided by GP)
Notes	Data from published paper. GPs in Netherlands have mean 6 contacts per year with people 75+ years old, with many contacts taking place at homes.

Moore 1997[10]	
Objective	To test the effectiveness of a 10-minute office-staff administered screen to evaluate malnutrition/weight loss, visual impairment, hearing loss, cognitive impairment, urinary incontinence, depression, physical limitation, and reduced leg mobility among older persons seen in office practice.
Methods	Design: RCT cluster (13 pairs of physicians matched by specialty [17 community-based internists, 9 family physicians]) Country: Los Angeles, USA Study Period: NR Inclusion criteria: 70 yrs or older, English speaking, not acutely or terminally ill, and able to answer questions; new visit or physical examination Exclusion criteria: NR
Participants	Recruitment: 8-12 from each practice; no specific protocol except inclusion criteria

	Sample: Intervention (n=112); Control (n=149) Mean age (SD): Intervention=77 (NR); Control=76 (NR) Race/ethnicity (%): White; Intervention=79; Controls= 81 Females (%): Intervention=65; Controls=59 Falls (%): NR Lives alone (%): NR Education (%): NR Income (%): NR Urban (%): NR Diabetes (%): NR Dementia (%): NR Residing in nursing home (%): NR Baseline vision loss: 19% reported difficulty with vision-related functions Other disorders of vision (%): NR Length of follow-up: 6 months; loss to follow-up: Intervention=13 (11%), Control=18 (12%)
Interventions	Intervention: Vision screening: 1) self-report vision problems, if positive then 2) Snellen chart Tool & administration of screening test: "Do you have difficulty driving or watching television or reading or doing any of your daily activities because of your eyesight? (even while wearing glasses)", followed by Snellen eye chart if positive; administered by trained office staff member Care in response to screening test: patient's clinical summaries with description and algorithm provided to physicians after assessments; provided with manuals and clinically pertinent articles Setting: community-based physician offices Other components of screening/assessment: nutrition, hearing, memory, urinary incontinence, depression, physical function, leg mobility Other components of intervention potentially impacting vision outcomes: none Control: Usual care; initial assessment had vision component
Outcomes	Benefits: Self-reported vision problems: proportion of patients noting improvement in vision problems Harms: NR Implementation: Referrals/recommendations for those eligible
Notes	Data from publication. Sensitivity of screening questionnaire previously shown to be 67% vs. geriatrician evaluation (for vision).

Wagner 1994[11]	
Objective	To evaluate the effectiveness of a disability and fall prevention intervention among senior HMO (health maintenance organization) enrollees.
Methods	Design: RCT Country: United States Study Period: NR Inclusion criteria: 65 years and older, ambulatory and independent in ADLs Exclusion criteria: too ill to participate (8%), in residential care.
Participants	Recruitment: random sample of patients 65 and over receiving care at 3 large group health cooperative clinics Sample: Intervention (n=635); Attention control (n=317); Usual Care (n=607) Mean age (SD): Intervention=72.5(NR); Attention control= 72.6(NR); Usual Care=72.5(NR) Race/ethnicity (% White); Intervention=94; Attention control=92; Usual Care=93 Females (%): Intervention=60; Attention control=57; Usual Care=59 Falls (%): Intervention=35; Attention control=31; Usual Care=33 (last 12 mos) Lives alone (%): NR Education (%): Intervention= 26; Attention control=24; Usual care=26 (college graduate) Income (%): Intervention= 35; Attention control=35; Usual care=33 (<$15,000 per yr) Urban (%): large metropolitan clinics in Seattle Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): exclusion criteria Baseline vision loss (%): Intervention=12; Attention control=7.9; Usual Care=12.7, p=0.08 (impaired vision via self-reported vision problems) Other disorders of vision: NR Length of follow-up: 24 mos; loss to follow-up: 5% total (53 deaths & 36 distributed proportionally across intervention groups).
Interventions	Intervention: Vision screening: self-reported vision problems Tool & administration of the screening test: with glasses, subject was unable to read newsprint or recognize a friend across the street; or vision problems were not correctable, and subject had difficulty doing such things as reading, seeing the numbers on the telephone, or telling whether the stove was on or off; self-administered mailed questionnaire Care in response to screening test: Received information from specially trained nurse/educator about resources in the community designed to assist those with poor

	vision; assessments also placed in medical records. Setting of program: clinic and telephone follow up calls Number of interactions after screening: one or two follow-up phone calls in the first month after the screening/assessment visit. Other components of screening/assessment: physical activity, prescription drug use, high-risk alcohol use, hearing, home hazards, blood pressure. Other components of intervention potentially impacting vision: home hazard interventions, medication review Attention control: Received an invitation to attend a chronic disease prevention visit that focused on assessments and counseling for cardiovascular disease prevention, breast and cervical cancer detection, influenza vaccination and seat belt use. Follow-up activities were limited to pamphlets and classes available at Group Health Cooperative. Control: Usual care at clinic; received vision assessment questions at baseline
Outcomes	Benefits: Self-reported visual problems (with glasses, subject was unable to read newsprint or recognize a friend across the street; or vision problems were not correctable, and subject had difficulty doing such things as reading, seeing the numbers on the telephone, or telling whether the stove was on or off) Harms: NR Implementation factors: NR
Notes	Data from published report and Smeeth 2006 via author contact. Results from the attention control and usual care groups have been combined for this review.

Van Rossum 1993[12]	
Objective	To assess the effect of preventive home visits by public health nurses on the state of health of and use of services by elderly people living at home.
Methods	Design: RCT Country: Netherlands Study period: NR Inclusion criteria: ages 75 to 84, living at home Exclusion criteria: receiving home nursing care
Participants	Recruitment: postal questionnaire to all subjects in the geographically defined area aged 75 – 84 years who were living at home (580 of 1036 eligible sampled); stratified prior to randomization by sex, self-rated health, composition of household and neighbourhood (as a marker of social class) Sample: Intervention (n=292); Control (n=288) Mean age: Intervention=72% aged 75-79, 28% 80-84; Control=73% aged 75-79,

	27% 80-84. Race/ethnicity: NR Females (%): Intervention=58; Controls=57 Falls (%): NR Lives alone (%): Intervention=39; Controls=39 Education (%): NR Income (%): NR Urban (%): conducted in Weert (60 000 inhabitants) Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): exclusion criteria Baseline vision loss: NR Other disorders of vision (%): NR Length of follow-up: 36 mos; loss to follow-up: Intervention=61 (20%; 42 deaths), Control=67 (23%; 50 deaths)
Interventions	Intervention: Vision screening: self-reported vision problems Tool & administration of screening test: “How do you assess your vision at present?”; administered by trained nurse Care in response to screening test: Those answering ‘fair’, ‘not so good’ or bad’ to the screening question advised by nurse to contact an optometrist. Setting of program: home visit Number of interactions after screening: 4 visits per year for 3 years, extra visits were done if necessary, telephone contact with the nurse was available Other components of screening/assessment: functional state, medication, social contacts and housing conditions Other components of intervention potentially impacting vision: regular home visits (4 visits per year over 3 years) and telephone calls as needed; no physical examinations but discussions, information, and advice provided based on checklist Control: No home visits; no vision assessment at baseline
Outcomes	Benefits: Self-reported vision problems: proportion answering fair, not so good or bad Harms: NR Implementation factors: NR
Notes	Data from published paper and Smeeth 2006 after their author contact.

Vetter 1992[13]	
Objective	To assess whether intervention by a health visitor could reduce the number of fractures, over a four year period, in those aged 70 and over.

Methods	Design: RCT Country: United Kingdom Study period: NR Inclusion criteria: registered with a general practice. Exclusion criteria: likely to refuse trial entry
Participants	Recruitment: patient lists of 5 GP offices of patients 70 years and older Sample: Intervention (n=350); Control (n=324) Mean age (SD): NR; all aged 70 and over (similar between groups) Race/ethnicity: NR Females (%): NR; similar distribution between groups Falls (%): 23% each group; fractures 3% annual prevalence each group Lives alone (%): NR Education (%): NR Income (%): NR Urban (%): NR Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): exclusion criteria Baseline vision: NR Other disorders of vision (%): NR Length of follow-up: 48 mos; loss to follow-up: Intervention=110 (31.4% [25% died]); Control=114 (35.2% [33% died])
Interventions	Intervention: Vision screening: self-reported vision problems Tool & administration of screening test: two questions about glasses and difficulty seeing and third question about recent eye exam; administered by research assistant Care in response to screening test: Those reporting difficulties seeing were referred by a health visitor to an optometrist or to their GP, and were offered advice from the health visitor. Setting of program: home visit within GP practices Number of interactions after screening: at least annually; as often as was thought necessary by the health visitor Other components of screening/assessment: annual assessment on nutrition, medical conditions, environment and improvement to general muscle tone and fitness aimed at reducing falls and fractures Control: Usual care; vision assessment at baseline
Outcomes	Benefits: Self-reported vision problems: proportion with a positive response to the question “Do you have any difficulty seeing (even when wearing your glasses)?”

	Harms: NR Implementation factors: NR
Notes	Data from published paper; definition of outcome measurement and results reported by Smeeth 2006 after their author contact.

McEwan 1990[14]	
Objective	To evaluate the effectiveness of a primary care linked screening programme to resolve health and related problems and to improve the quality of life of elderly people.
Methods	Design: RCT Country: United Kingdom Study period: 1986-1988 Inclusion criteria: 75 years and over who were registered with a Newcastle practice in 1986 Exclusion criteria: too ill for assessment, in hospital
Participants	Recruitment: registered patients of a general practice in Newcastle Sample: Intervention (n=151); Control (n=145) Mean age (SD): NR, ≥75 Race/ethnicity: NR Females (%): NR Falls (%): NR Lives alone (%): NR (no difference between groups) Education (%): NR Income (%): NR, wide diversity of social classes Urban (%): NR, urban residential area Diabetes (%): NR Dementia (%): NR Residing in nursing homes (%): NR (some, but no difference between groups) Baseline vision loss: 23% difficulty reading newspaper Other disorders of vision (%): NR Length of follow-up:20 months; loss to follow-up: Intervention=33 (22%); Control=34 (23%)
Interventions	Intervention: Vision screening: self-reported vision problems Tool & administration of screening test: question about vision (difficulty reading ordinary newsprint) in initial interview with community nurse interviewer; additional screening by care planning nurse Care in response to screening test: Care planning nurse gave advice and or referred to an optometrist those reporting “always” OR “quite often” problems; primary care team consultation.

	Setting of program: home visit Number of interactions after screening & duration of intervention: 1 visit Other components of screening/assessment: multicomponent home nurse assessment and care plan: ADLs, social functioning, current medical problems, compliance with medication Other components of care potentially impacting vision: Care plan activities related to medication, social function etc. Provision of a booklet describing health, social and voluntary services. Control: Usual care from primary care team; received screening assessment
Outcomes	Benefits: Self-reported vision problems: proportion who “always” or “quite often” had difficulty reading ordinary newsprint (with glasses worn) Harms: NR Implementation factors: NR
Notes	Published and unpublished data. Data on outcome measurement and results reported by Smeeth 2006 after their author contact.

Vetter 1984[15]	
Objective	To test the effectiveness of health visitors’ visiting and monitoring of a caseload of elderly people in their respective general practices.
Methods	Design: RCT Country: United Kingdom Study period: NR Inclusion criteria: born in 1909 or before (70 years old or over), living at home, patient at one of two general practices Exclusion criteria: permanent residential care
Participants	Recruitment: age-sex register of 2 general practices (10 GPs in total) of all patients born in 1909 or before, living at home Sample: Intervention (n=577); Control (n=571) Mean age (SD): NR; all over age 70 Race/ethnicity: NR Females (%): NR Falls (%): NR Lives alone (%): NR Education (%): NR Income (%): NR, higher socioeconomic status in rural area Urban (%): Intervention= 51; Controls=52 Diabetes (%): NR Dementia (%): NR

	Residing in nursing homes (%): exclusion criteria Baseline vision loss: NR Other disorders of vision (%): NR Length of follow-up: 24 mos; loss to follow-up: Intervention=89 (15.4%; 80 deaths), Control=115 (20%; 105 deaths)
Interventions	Intervention: Vision screening: self-report vision problems Tool & administration of screening test: two questions about glasses and difficulty seeing; health visitor Care in response to screening test: Those reporting difficulties seeing were referred by the health visitor to an optometrist or to their GP and were offered advice from the health visitor. Setting of program: home visits within GP practices Number of interactions after screening: one unsolicited visit a year plus extras as needed Other components of screening/assessment: semi-structured questions about physical, mental and social characteristics Other components of intervention potentially impacting vision: annual home visits with assessments and advice including information on services, benefits and allowances Control: Usual care; no home visits but received initial interview with screening question
Outcomes	Benefits: Self-reported vision problems: proportion with a positive response to the question "Do you have any difficulty seeing (even when wearing your glasses)" Harms: NR Implementation factors: NR
Notes	Data from published paper and systematic review with author contact for results.

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