

Effectiveness and Cost-effectiveness of General Health Checks in Adults: A Systematic Review

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Abstract

Introduction:

General health checks (GHCs) are widely used for disease prevention, yet their clinical effectiveness, psychological impact, and economic value remain uncertain. This study systematically evaluated the effectiveness and cost-effectiveness of GHCs in adults.

Methods:

We searched PubMed, Embase, Cochrane Library, Web of Science, CINAHL, SinoMed, CNKI, and WanFang from inception to July 1, 2025, using a comprehensive strategy combining controlled vocabulary (e.g., MeSH, Emtree) and free-text terms. Multiple reviewers independently screened titles, abstracts, and full texts. We included randomized clinical trials (RCTs), nonrandomized controlled trials (NRCTs), observational studies with control groups, and economic evaluations comparing GHCs with usual care in adults. Risk of bias was assessed using Cochrane RoB 2.0, ROBINS-I, and other validated tools. Data were synthesized narratively due to heterogeneity.

Results:

A total of 74 articles representing 56 unique studies (including 22 RCTs, 5 NRCTs, 25 observational studies, 3 economic evaluation studies, and 1 mixed-methods study) involving more than 17 million participants were included. RCTs consistently showed no significant reduction in all-cause mortality or cardiovascular events compared with usual care, whereas high-risk subgroups and observational studies frequently suggested protective associations. GHCs were associated with increased detection of chronic diseases, greater uptake of preventive services, and modest improvements in patient-reported outcomes. While GHCs modestly improve diet and physical activity, most trials found little or no effect on smoking or hazardous alcohol use. Economically, GHCs reduced short-term healthcare costs and high-cost service utilization, but long-term cost-effectiveness remains debatable. While psychological effects were generally positive or neutral, increased suicide risk was observed in older adults in one large cohort.

Conclusions:

General health checks do not reduce mortality or cardiovascular events in the general population but are associated with earlier disease detection, modest risk-factor improvements, greater use of preventive care, small psychological benefits, and reductions in short-term healthcare costs. Current evidence does not support a "one-size-fits-all" approach. Future implementation should prioritize risk-stratified models targeting high-risk groups to ensure we aren't just wasting resources but actually delivering clinical value.

Systematic review registration:

The study protocol was registered with PROSPERO (CRD42022326697).

1. Background

General health checks (GHCs) represent a widely implemented preventive strategy for adults in many high-income countries. The term “GHCs” encompasses a broad spectrum of practices, variously described as periodic health examinations or multiphasic screenings, with implementation varying significantly in frequency, duration, and content.^[1, 2] For the purpose of this review, GHCs are defined as broad operational preventive assessments for adults aimed at synthesizing evidence across this heterogeneous landscape. The goal of such screening is to detect illness at an early stage and identify risk factors that can be modified, thereby triggering timely care to prevent later morbidity and mortality.^[3, 4] However, implementing this at scale requires substantial resources and raises valid concerns about harms such as overdiagnosis, overtreatment, and the diversion of funds. This significant expenditure contrasts with the ongoing debate over the actual clinical value of GHCs.^[5] It is also worth noting that while prior syntheses largely concentrated on morbidity and mortality, there is a lack of consensus regarding the broader implications of GHCs—specifically their cost-effectiveness in real-world settings and impact on psychological health.^[6, 7]

Current evidence on GHCs is largely informed by a 2021 review by Liss et al., which found no significant reduction in mortality or cardiovascular events.^[2] However, an updated review is necessary. New data has emerged from large, long-term studies, including findings from developing nations that provide a more global view. Additionally, by widening our search across more databases, this review attempts to identify relevant studies more exhaustively, thereby cutting down on publication and language biases. Finally, data on psychological outcomes and economic value remains scattered. To the best of our knowledge, this is the first systematic review to simultaneously examine these clinical, psychological, and economic angles.

2. Methods

2.1 Protocol and registration

The study protocol was registered with PROSPERO (CRD42022326697). This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guideline for the conduct and reporting of the study.^[8]

2.2 Search strategy

We searched PubMed, Embase, the Cochrane Library, Web of Science, CINAHL via EBSCO, SinoMed, CNKI, and WanFang from database inception to July 1, 2025. The search strategy utilized a combination of controlled vocabulary (e.g., MeSH, Emtree) and free-text terms related to general health checks (e.g., “health check*,” “periodic health examination,” “multiphasic screening,” “physical examination”) and primary care settings. These were combined with study design filters for RCTs, NRCTs, and observational studies with control groups. To identify economic evaluations, the search strategy additionally

incorporated specific keywords related to costs, cost-effectiveness, and economic modeling. Searches in Chinese databases utilized corresponding Chinese terms. The search was restricted to studies involving human adults and published in either English or Chinese. To ensure comprehensiveness, we also manually screened the reference lists of included articles and relevant systematic reviews^[2, 4, 9, 10] to identify additional studies. The full electronic search strategies are detailed in the **eAppendix in the Additional file 1**.

2.3 Inclusion and exclusion criteria

Study eligibility criteria were established based on the PICOS (Population, Intervention, Comparator, Outcome, and Study design) framework (Table 1).^[11]

Table 1
Inclusion and Exclusion Criteria Based on the PICOS Framework

Criteria	Inclusion	Exclusion
Population	• Adults (≥ 18 years) from the general population in primary care or community settings	• Studies on special groups such as patients with dementia and autism
Intervention	• General health checks (GHCs): multi-component health assessments for individuals, including single, multiple, or periodic checks • May include brief interventions (e.g., health counseling) as an integral part of the GHC	• Screening programs limited to a single disease or single risk factor
Comparators	• No health check • Usual care • Alternative physical examination protocols	• Studies lacking a concurrent control group
Outcome	Studies reporting ≥ 1 of the following: Effectiveness Outcomes: • Mortality: All-cause and cause-specific • Clinical Events: cardiovascular outcomes and chronic disease diagnosis • Risk Factors Control • Healthcare Utilization • Health Behaviors • Patient-Reported Outcomes (PROs) • Psychological Outcomes Economic Outcomes • Total healthcare costs • High-cost services • Formal economic evaluations	• Studies not reporting any prespecified outcome of interest
Study design	• Randomized controlled trials (RCTs) • Nonrandomized controlled trials (NRCTs) • Observational studies with control groups	• Case series, case reports, editorials, reviews • Study protocols and ongoing trials • Articles for which full text was unavailable

2.4 Literature selection and data extraction

Search results were imported into EndNote reference management software, and duplicates were removed. Three reviewers (Y.W., Q.Z., and X.Z.) independently screened titles and abstracts to identify potentially relevant studies. Subsequently, full-text articles were assessed for eligibility based on the PICOS framework by 2 reviewers (Y.W. and Q.Z.). Disagreements were resolved through discussion or consultation with a third reviewer (X.Z.). To ensure literature saturation, 2 reviewers (Y.W. and Q.Z.) independently screened the reference lists of included studies, while citation tracking was performed by X.Z.

Data extraction was performed independently by 2 reviewers (Y.W. and Q.Z.) using a standardized Microsoft Excel spreadsheet developed through group discussion and guided by the Cochrane Handbook for Systematic Reviews of Interventions.^[12] In cases of missing data, corresponding authors were contacted. The following data were extracted: author (year), country, setting, study design, sample, intervention, comparison, follow-up duration, outcome of interest, and main findings.

2.5 Risk of Bias and Quality Assessment

Risk of bias was assessed using 6 validated instruments tailored to specific study designs. RCTs were evaluated using the revised Cochrane Risk of Bias tool (RoB 2.0)^[13] which assesses 5 domains to derive an overall judgment of low risk, some concerns, or high risk of bias. NRCTs were assessed using the ROBINS-I tool, covering 7 domains to categorize bias risk as low, moderate, serious, or critical.^[14, 15] Cohort studies were appraised using the Newcastle-Ottawa Scale (NOS),^[16] and cross-sectional studies were evaluated using the Joanna Briggs Institute (JBI) critical appraisal checklist.^[17] Economic evaluation studies were assessed using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) 2022 checklist,^[18] and mixed-methods studies were evaluated using the Mixed Methods Appraisal Tool (MMAT) 2018 version.^[19] For these designs, methodological quality was categorized as high, moderate, or low based on prespecified scoring thresholds (**eTable 1 in the Additional file 2**). Two reviewers (Y.W. and Q.Z.) independently performed the assessments, with disagreements resolved by a third reviewer (X.Z.).

2.6 Data Synthesis

Given the substantial heterogeneity in study populations, interventions, and outcome measures, a quantitative meta-analysis was not feasible. Consequently, a narrative synthesis was conducted. Results were structured and presented according to the prespecified outcome categories identified in the included studies.

3. Results

3.1. Study selection

As shown in Fig. 1, the systematic search across 8 databases identified 29,805 initial records. After removing 7,841 duplicates, 21,964 records remained for screening. Based on titles and abstracts, 21,759

records were excluded. Full texts were sought for the remaining 205 records; 17 could not be retrieved, and 130 were excluded after full-text review based on the eligibility criteria. This process yielded 58 articles. Additionally, 16 relevant articles were identified through manual screening of 4 previous systematic reviews.^[2, 4, 9, 10] In total, 74 articles representing 56 unique studies were included in this systematic review.

3.2. Study characteristics

The review included 22 RCTs,^[20–58] 19 cohort studies,^[59–78] 6 cross-sectional studies,^[79–84] 5 NRCTs,^[85–89] 3 economic evaluation studies,^[90–92] and 1 mixed-methods study.^[93] Each study's characteristics are summarized in **eTable 2 in the Additional file 3**. The 56 included studies comprised more than 17,145,442 participants, with publication dates spanning 52 years (1973–2025). Follow-up duration ranged from 2 months to 30 years, with 1 modeling study employing a lifetime simulation horizon (up to 50 annual cycles).

The included studies were conducted in 12 countries across North America, Europe, and Asia. The majority originated from high-income countries. The United States contributed the most studies (14 [25.0%]), followed by the United Kingdom (12 [21.4%]), China (8 [14.3%]), Denmark (6 [10.7%]), and Sweden (6 [10.7%]) (Fig. 2). Most studies were set in primary care practices, with others based in community or workplace settings. Participant ages ranged from 18 to 100 years, and 13 studies (23.2%) were restricted to older adults (aged ≥ 65 years). Compared with earlier reviews dominated by North American data,^[2] the current sample included a broader range of European and Asian studies, although evidence from low- and middle-income countries remained scarce.

3.3 Risk of Bias and Quality Assessment

Among the 22 RCTs, 1 (4.3%) was rated as having a low risk of bias, 7 (30.4%) as having some concerns, and 14 (65.2%) as having a high risk of bias (Fig. 3). Of the 5 NRCTs, 2 (40.0%) had a moderate risk of bias, and 3 (60.0%) had a serious risk. Regarding methodological quality, 18 of 19 cohort studies (94.7%) were rated as high quality, and 1 (5.6%) was rated as moderate quality. Of the 6 cross-sectional studies, 4 (66.7%) were rated as high quality and 2 (33.3%) as moderate quality. All 3 economic evaluation studies were rated as high quality, and the single mixed-methods study was rated as moderate quality. Detailed assessment results for each study design are presented in **eTable 3–8 in the Additional file 3**.

- 1. (A) Study-level overall risk-of-bias judgments for each randomized controlled trial.
- 2. (B) Domain-specific distribution of risk-of-bias judgments across all randomized controlled trials.

3.4 Effectiveness of General Health Checks

3.4.1 Mortality

GHCs were not consistently associated with changes in mortality. A total of 22 studies reported at least 1 mortality outcome, including 13 RCTs,^[22, 29, 31, 33, 34, 39, 40, 42, 46, 47, 49, 50, 55, 57, 58] 8 observational studies,^[63, 66, 68, 69, 71, 72, 77, 78] and 1 economic evaluation.^[90] Overall, 10 of 13 the RCTs found no significant reduction in all-cause mortality compared with usual care among the general population.^[22, 29, 31, 33, 42, 46, 47, 49, 50, 55] For example, in a large Swedish trial (n = 32,186), a 1-time combined medical, psychological, and social assessment was not associated with a significant difference in 22-year all-cause mortality (RR, 1.03; 95% CI, 0.94–1.14), cardiovascular mortality, cancer mortality, or accidental death after adjustment.^[33] Similarly, the Ebeltoft Health Promotion Project (n = 3,464) found no difference in 25-year all-cause mortality between invitees and noninvitees (HR, 0.93; 95% CI, 0.75–1.16).^[29] Notably, 2 of these trials even indicated potential harm. In the A Healthy Future trial (n = 2,558), mortality was higher in the group offered a 2-year preventive services package (9.8% vs 8.2%; P = .06), particularly among participants aged 75 years or older (18.6% vs 13.5%; P = .05).^[46] Similarly, in the Inter99 study (n = 59,616), women in intervention areas with high participation had a 32% higher risk of death over 10 years compared with controls (HR, 1.32; 95% CI, 1.03–1.69),^[57] driven by lifestyle-related and cancer-related mortality.^[58]

However, modest mortality benefits were observed in 4 RCTs^[34, 39, 40, 47] targeting high-risk or older populations and in 6 high-quality cohort studies.^[63, 69, 71, 72, 77, 78] For instance, although one early trial (n = 30,022) found no overall benefit, it reported that a high-risk subgroup of men (baseline SBP $\geq$ 175 mm Hg) had 40% lower total mortality and 30–37% lower cardiovascular mortality compared with historical controls (P < .001).^[47] Regarding older adults, the remaining three trials also observed small but statistically significant reductions in mortality.^[34, 39, 40] For example, in the Senior Health Watch trial (n = 4,195), older participants receiving preventive and counseling visits had lower mortality than those in usual care at 2 years (8% vs 11%; P = .003) and 6 years (19% vs 22%; P = .02).^[34] Consistent with these trial results, a large Chinese cohort of 625,279 older adults also found that regular health checks were associated with substantially lower cardiovascular mortality (HR, 0.44; 95% CI, 0.43–0.45) and all-cause mortality (HR, 0.44; 95% CI, 0.44–0.45), with stronger associations among those with diabetes, dyslipidemia, or hypertension.^[69]

3.4.2 Clinical Events

A total of 10 studies evaluated cardiovascular outcomes.^[29, 40, 47, 49, 55, 67, 71, 86, 88, 92] Strikingly, all 5 RCTs^[29, 40, 47, 49, 55] and 2 NRCTs^[86, 88] consistently failed to show a significant reduction in the incidence of cardiovascular events among the general population. In the DanMONICA trial (n = 17,845), participants in the intervention group were invited to up to 3 health checks, yet the 30-year incidence of ischemic heart disease did not differ significantly from that in the usual care group (HR, 0.99; 95% CI, 0.92–1.07); notably, the incidence of stroke was significantly higher in the health check group (HR, 1.14; 95% CI, 1.04–1.25).^[49] However, benefits were identified in specific high-risk subgroups. An early influential trial showed that although physical examination could not reduce the cardiovascular incidence rate of ordinary men, in the high-risk subgroup with baseline systolic blood pressure $\geq$ 175 mm Hg, the 10-year

stroke incidence rate decreased by 30%.^[47] In stark contrast to the evidence from controlled trials, the included observational studies^[67, 71] and an economic evaluation^[92] suggested a protective association. In the annual physical examination for older adults aged 65 and above in Japan, compared to those who participated in the examination non-participation was specifically associated with increased stroke-related certification in pre-old men (65–74 years), suggesting a protective effect of participation.^[67] Similarly, a high-quality British cohort found that, over the longer term (≥ 2 years), health checks were associated with significant reductions in the incidence of myocardial infarction (HR, 0.85; $P < .05$) and atrial fibrillation (HR, 0.91; $P < .05$).^[71]

A total of 13 studies reported that general health checks were associated with higher detection of chronic conditions,^[22, 31, 38, 59, 62, 67, 70, 71, 73, 74, 81, 87, 88] including 3 RCTs,^[22, 31, 38] 2 NRCTs^[87, 88] and 8 observational studies.^[59, 62, 67, 70, 71, 73, 74, 81] For somatic diseases, a UK cohort of 138,788 participants, compared with nonparticipants, NHS health check participants had a 3.3 percentage point increase in hypertension diagnosis, a 1.4 percentage point increase in type 2 diabetes diagnosis, and a 0.2 percentage point increase in chronic kidney disease diagnosis.^[59] Notably, this improved detection extends beyond somatic conditions to mental health. Three studies have found that physical examinations are associated with a higher rate of newly diagnosed depression.^[38, 62, 70] Interestingly, while a Danish trial found no significant difference in the detection of hypertension, hypercholesterolemia, diabetes, or COPD, it reported that the diagnosis rate of depression in the intervention group was more than twice that of the control group (OR, 2.90; 95% CI, 1.34–6.29).^[38] A study in Taiwan reported that the rate of newly treated depression in the screening group was 63% higher (HR, 1.63; 95% CI, 1.62–1.64).^[62] Similarly, a US study found that completion of physical examinations during the COVID-19 pandemic was significantly associated with a higher diagnosis rate of depression compared with controls.^[70]

3.4.3 Risk Factor Control

Among 16 studies evaluating risk factor control,^[20, 24, 30, 38, 41, 44, 47, 50, 59, 61, 64, 75, 84, 85, 88, 89] 13 reported improvements in blood pressure, lipid profiles, or composite cardiovascular risk scores associated with general health checks.^[20, 24, 30, 41, 44, 47, 59, 64, 75, 84, 85, 88, 89] These included 6 RCTs,^[20, 24, 30, 41, 44, 47] 2 NRCTs,^[88, 89] and 5 observational studies.^[59, 64, 75, 84, 85] In the Family Heart Study ($n = 12,472$), participation in the health check, compared with nonparticipation, was associated with decreased Dundee coronary risk score. Systolic blood pressure decreased by 6.2 mm Hg in women and 7.3 mm Hg in men, and diastolic blood pressure decreased by 3.0 mm Hg in women and 3.5 mm Hg in men.^[30] Similarly, a hospital-based vascular screening program in the Netherlands ($n = 1170$) demonstrated that systolic blood pressure decreased by 2.5 mm Hg and LDL cholesterol levels decreased by 0.3 mmol/L among participants who underwent screening compared with those receiving usual care.^[85] Conversely, 3 studies reported no significant differences in risk factor control between intervention and control groups.^[38, 50, 61]

3.4.4 Healthcare Utilization

A total of 6 RCTs^[21–23, 37, 42, 46] and 4 observational studies^[61, 70, 82, 83] reported higher utilization of clinical preventive services. In a German RCT (n = 1,401), participants in the check-up 45 + group applied for rehabilitation and prevention services significantly more often than those receiving usual care (12.0% vs 2.9%; P < .001), and higher proportions had services approved and completed (8.4% vs 2.4%; 7.2% vs 2.3%; P < .001 for both).^[21] Similarly, in a Canadian study of women aged 20 years or older (n = 2,332), those attending periodic health examinations were more likely than those without regular checks to receive Pap smears (OR, 6.7; 95% CI, 4.6–9.8), mammograms (OR, 3.7; 95% CI, 2.3–5.9), bone densitometry (OR, 3.7; 95% CI, 1.3–10.5), and cholesterol testing (OR, 3.0; 95% CI, 2.0–4.5), with testing rates increasing in correlation with the frequency of annual physician visits.^[82]

Regarding medication use, 3 RCTs,^[22, 40, 47] 1 NRCT,^[88] and 5 observational studies^[59, 64, 73, 74, 75] reported increased initiation of preventive pharmacotherapy associated with GHCs. In the Viborg Vascular (VIVA) trial (n = 50,156), participants in the screening group were significantly more likely to initiate antithrombotic (HR, 2.30), lipid-lowering (HR, 2.10), and antihypertensive therapy (HR, 1.57) compared with controls.^[40] Similarly, in a large UK cohort (n = 3,492,816), NHS Health Check attendees were more likely than nonattendees to be prescribed statins (HR, 2.98; 95% CI, 2.84–3.13) and antihypertensive medications (HR, 1.65; 95% CI, 1.59–1.72).^[74]

By contrast, GHCs were not consistently associated with reduced hospital utilization; A total of 6 RCTs^[22, 26, 31, 40, 43, 50] and 2 observational studies^[61, 68] evaluated hospital utilization. Overall, the RCTs generally did not demonstrate a reduction in utilization, with findings ranging from null effects to increased burdens. Three RCTs^[26, 31, 50] and one observational study^[61] found no significant difference in total hospital days or admission rates. Two other trials revealed complex patterns. One study found that hospital usage was slightly lower among men but slightly higher among women, yielding no overall benefit.^[22] Similarly, the VIVA trial showed that fewer inpatient days for peripheral arterial disease and hypertension were offset by increases for chronic obstructive pulmonary disease and stroke, resulting in no net reduction in hospital burden.^[40] Notably, Olsen et al.^[43] even observed significantly more hospital nights among screened participants at 1 year, a finding potentially linked to poor follow-up on detected abnormalities. However, one exception was a Finnish cohort study,^[68] which observed a substantial 67% reduction in ED visits (IRR, 0.33; P < .001) in the intervention group over three years.

3.4.5 Health Behaviors

A total of 13 studies evaluated health behaviors,^[30,35,38,41,44,46,47,50,64,75,88,89,93] including 8 RCTs,^[30, 35, 38, 41, 44, 46, 47, 50] 2 NRCTs,^[88, 89] 2 observational studies,^[64, 75] and 1 mixed-methods study.^[93] Results varied significantly by the type of behavior targeted and study design. Studies evaluating diet and physical activity commonly observed positive outcomes. For example, in the Minnesota Heart Health Project (n = 847), participants receiving a screening and education program had significantly higher physical activity

levels (3,081 vs. 2,401 kcal/week; $P < .01$) and were more likely to select low-fat and low-sodium foods compared with controls.^[41]

However, for the two addictive behaviors of smoking and alcohol consumption, findings diverged notably according to study design. Strikingly, all 8 RCTs^[30, 35, 38, 41, 44, 46, 47, 50] evaluating these behaviors consistently indicated that GHCs did not reduce smoking or alcohol consumption. For example, in a Danish RCT among adults aged 45 to 64 years ($n = 1,104$), no significant differences were observed at 12 months between intervention and control groups in daily smoking (OR, 0.99; 95% CI, 0.76–1.30) or binge drinking (OR, 0.82; 95% CI, 0.59–1.14).^[38] In contrast, all 5 nonrandomized studies^[64, 75, 88, 89, 93] reported positive associations. In a high-quality UK cohort ($n = 450,801$), health check participants had a lower smoking prevalence after 6 years compared with nonparticipants (OR, 0.90; 95% CI, 0.87–0.94).^[75] In a study of older adults in China, the management group showed significantly greater reductions in alcohol consumption compared with controls (10.0% vs 28.0%; $P < .05$).^[89]

3.4.6 Patient-Reported Outcomes (PROs)

A total of 11 studies^[23, 37, 39, 40, 42, 43, 46, 50, 54, 79, 89] evaluated patient-reported outcomes, including quality of life, self-rated health, and patient satisfaction. Among these, 9 studies reported small improvements in PROs associated with GHCs, including 7 RCTs,^[23, 37, 39, 40, 42, 46, 54] 1 NRCT,^[89] and 1 observational study.^[79] For example, a RCT conducted in the United States ($n = 1914$) reported modest improvements in multiple quality-of-life measures in the intervention group compared with the control group over a 2-year follow-up period.^[42] Conversely, 2 trials—the Multiphasic Health Checkup Evaluation Study^[43] and the South-East London Screening Study^[50]—found no significant differences in self-reported health status or quality of life between intervention and control groups.

3.4.7 Psychological Outcomes

A total of 10 studies evaluated mental health outcomes,^[20, 28, 38, 40, 46, 51, 53, 54, 62, 70, 79] including 7 RCTs^[20, 28, 38, 40, 46, 51, 53, 54] and 3 observational studies.^[62, 70, 79] Overall, GHCs demonstrated predominantly positive or neutral effects on depression, anxiety, or psychological distress. In the Inter99 study, health checks did not increase distress; instead, they were associated with temporary alleviation of anxiety, depression, and somatization, with some improvements persisting for up to 10 months,^[53] as well as longer-term improvements in physical and mental health over a 5-year follow-up period. ($P < .001$).^[54] Additionally, several studies reported that health checks were associated with higher detection rates of depression.^[38, 62, 70]

However, a high-quality cohort study from Taiwan ($n = 9,584,456$) revealed a complex association: screening was linked to a reduced risk of psychiatric hospitalization (HR, 0.93; 95% CI, 0.91–0.95) but, conversely, a higher risk of suicide among adults aged 65 years or older.^[62] Finally, potential psychological benefits appeared transient; the Ebeltoft Health Promotion Project found no measurable psychological effects after 25 years of follow-up.^[28]

3.5 Economic outcomes

3.5.1 Total healthcare costs

A total of 14 studies evaluated economic outcomes,^[23, 28, 35, 42, 46, 50, 61, 66–68, 76, 90–92] including 6 RCTs,^[23, 28, 35, 42, 46, 50] 5 observational studies,^[61, 66–68, 76] and 3 formal economic evaluation studies.^[90–92]

Overall, GHCs were associated with reductions in total healthcare costs. For example, in the Senior Health Watch trial, the intervention group showed a 2.5% reduction in total medical insurance costs in the second year compared with the control group.^[35] Another study similarly reported that participants receiving annual wellness visits experienced a 5.7% decrease in total healthcare costs within 11 months compared with nonparticipants.^[61] Additionally, 2 long-term US reports found per capita net savings of US\$190 over 3 years^[42] and US\$822 over 7 years^[90] among individuals attending health checks.

3.5.2 High-cost services

GHCs were associated with reduced utilization of high-cost services, particularly emergency department (ED) visits and hospitalizations, which are also key drivers of cost savings. In a Finnish study of adults aged 75 years or older, the emergency visit rate in the screening group decreased by 67% over 3 years (incidence rate ratio [IRR], 0.33; 95% CI, 0.17–0.63), and ED costs decreased from €53 to €8 per person-year (mean ratio, 0.15; 95% CI, 0.10–0.71). In contrast, the control group experienced a 19% increase in emergency visits (IRR, 1.19; 95% CI, 1.08–1.31) and an increase in ED costs from €148 to €183 (mean ratio, 1.24; 95% CI, 1.08–1.40).^[68]

3.5.3 Formal economic evaluations

Formal economic evaluations provided divergent findings regarding cost-effectiveness. A UK analysis estimated that health checks yielded an incremental gain of 0.05 quality-adjusted life-years (QALYs) while reducing disease-related costs by £170. The calculated incremental cost-effectiveness ratio (ICER) was £900 per QALY gained, suggesting high cost-effectiveness.^[91] In contrast, a study from Australia presented less favorable results. While health checks increased lifetime QALYs (0.008 for males; 0.003 for females), the estimated ICERs were AU\$42,355 per QALY gained for males and AU\$133,504 for females. Probabilistic sensitivity analysis demonstrated that, at a willingness-to-pay threshold of AU\$28,000 per QALY, the probability of cost-effectiveness was only 17.5% for males and 0% for females, suggesting that GHCs were unlikely to be cost-effective in this specific setting.^[92] Formal economic evaluations produced heterogeneous results across settings.

Table 2
Summary of Findings Across Outcome Domains

Outcome domain	No. of studies	Summary of findings
Mortality	22 studies (13 RCTs, 8 observational studies, 1 economic evaluation study)	No consistent survival benefit in the general adult population; possible modest benefit in high-risk or older adults, with rare signals of harm in a few trials.
Cardiovascular events	10 studies (5 RCTs, 2 NRCTs, 2 observational studies, 1 economic evaluation study)	No significant reduction in cardiovascular events in RCTs, contrasting with protective associations in observational studies.
Chronic disease diagnosis	13 studies (3 RCTs, 2 NRCTs, 8 observational studies)	Consistently higher detection of some chronic diseases and depression across all study designs.
Risk Factor Control	16 studies (8 RCTs, 2 NRCTs, 6 observational studies)	Modest improvements in blood pressure, lipid profiles, BMI, and composite cardiovascular risk scores were observed in the majority of studies.
Healthcare Utilization	23 studies (12 RCTs, 1 NRCT, 10 observational studies)	Increased uptake of preventive services and medications, but generally not associated with reduced hospital utilization across.
Health Behaviors	13 studies (8 RCTs, 2 NRCTs, 2 observational studies, 1 mixed-methods study)	Improved diet and physical activity, but RCTs found no effect on smoking or alcohol, unlike observational studies.
Patient-Reported Outcomes (PROs)	11 studies (9 RCTs, 1 NRCT, 1 observational study)	Nine studies reported modest improvements in quality of life or patient satisfaction, whereas 2 studies observed no significant changes.
Psychological Outcomes	10 studies (7 RCTs, 3 observational studies)	Generally, mental health effects were positive or neutral, but one cohort highlighted increased suicide risk in older adults.
Economic Outcomes	14 studies (6 RCTs, 5 observational studies, 3 economic evaluation studies)	Associated with reductions in total costs and high-cost service use, but long-term cost-effectiveness varied significantly by country-specific settings.

4. Discussion

In this comprehensive systematic review, we provide an updated evaluation of GHCs across multiple outcome domains. We found no consistent evidence that routine GHCs reduce all-cause mortality, major cardiovascular events, or hospitalizations, especially in large-scale, long-term RCTs. Conversely, GHCs were consistently associated with increased detection of chronic diseases, improved risk factor control, and greater uptake of preventive services and pharmacotherapy. While the impact on health behaviors was mixed, patient-reported outcomes generally improved. Crucially, this synthesis covers two frequently neglected areas: economic outcomes and mental health. We found that while the psychological effect is

largely positive or neutral, risks do exist, especially for older adults. Furthermore, we identified evidence linking GHCs to cost savings and potential cost-effectiveness in specific settings, challenging long-held assumptions about their purely additive economic burden. Importantly, both the direction and magnitude of effects differed across study designs, baseline risk profiles, and intervention components, suggesting that how and to whom health checks are delivered may be more important than simply whether they are offered.

Although improvements in cardiovascular risk factors, such as blood pressure and lipid levels, were observed, significant reductions in all-cause mortality and cardiovascular events were absent in the general population. This finding aligns with previous major systematic reviews. However, our analysis offers critical nuance. The mortality benefits observed exclusively in high-risk or older populations^[34, 39, 40, 47] likely represent scenarios where baseline risk is sufficient for modest risk factor improvements to translate into a statistically detectable survival advantage. This pattern may also reflect the time lag between improvements in risk factors and measurable effects on hard clinical outcomes. In populations at relatively low baseline risk, the magnitude of risk reduction may be insufficient to produce observable differences in survival during the follow-up periods typical of randomized trials. This hypothesis is further supported by our findings on cardiovascular events: while RCTs in general populations showed no benefit,^[29, 40, 47, 49, 55] studies of older adults or high-risk subgroups suggested long-term reductions in myocardial infarction and stroke.^[47, 67] Collectively, these findings suggest that GHCs are unlikely to yield survival benefits in unselected adult populations but may be clinically meaningful when targeted at older adults or individuals with elevated cardiovascular risk. From a public health perspective, these findings challenge the one-size-fits-all approach to health checks and highlight the potential value of more stratified prevention strategies, in which resources are preferentially directed to individuals exceeding specific risk thresholds and thus more likely to derive measurable survival benefits.

Our data suggests the real power of GHCs is not as a cure, but as an entry point into preventive medicine. We observed that these checks excel at case-finding, driving up diagnosis rates for a wide range of chronic issues, from diabetes and hypertension to depression.^[22, 31, 38] Once these conditions are spotted, clinical action typically follows: screened participants were consistently more likely to start necessary preventive pharmacotherapies^[22, 40, 47] and preventive services.^[21–23, 37, 42, 46] However, this creates a policy imperative: screening is futile without a robust primary care infrastructure to manage the findings. Policy should not focus solely on the "check" but on the "follow-through." A positive screen that does not lead to sustained, evidence-based management is merely an administrative burden. Therefore, GHCs function best not as standalone events but as integrated entry points into a chronic disease management ecosystem.

When we look at health behaviors, the results split in two directions. While health checks appeared to encourage better diet and physical activity, RCTs consistently showed they had little impact on smoking or alcohol use. This gap implies that while brief advice during a check-up can prompt lifestyle tweaks, it is rarely enough to break addictive behaviors, which likely require more intensive, specialized help. On the

other hand, patients generally reported better quality of life and satisfaction, suggesting they personally value the reassurance these assessments provide. However, this benefit carries a complex caveat regarding mental health. While most findings on anxiety and depression were neutral or positive, the signal of increased suicide risk in certain older populations points to a potential double-edged effect.^[62] Consequently, preventive programs cannot simply treat psychological screening as an add-on; for older adults in particular, structured mental health support and suicide risk monitoring must be integrated directly into the process.

A key feature of this update is our detailed look at economic outcomes, an area largely ignored by earlier reviews. We found that GHCs link to short-term drops in overall healthcare costs, a trend likely fueled by fewer visits to emergency departments and hospitals.^[61, 68] The picture for long-term cost-effectiveness, however, is far from uniform. Models from the UK suggest that GHCs can be highly cost-effective, showing ratios well below standard willingness-to-pay thresholds.^[91] In contrast, Australian data implies that routine checks may fail to offer value for money in the general population, especially among women.^[92] This divergence reflects differences in baseline healthcare costs, population risk profiles, and the design and frequency of the health checks themselves, highlighting that cost-effectiveness depends heavily on the specific context and policies. For policymakers, this shifts the debate. Instead of seeing GHCs purely as a drain on resources, they may be more appropriately seen as a strategic investment that can improve resource use, provided they are targeted to high-risk populations, focus on interventions that address key cost drivers, and are integrated with primary care and chronic disease management. At the same time, equity considerations should be kept in mind to ensure that the benefits of health checks are accessible across different population subgroups.

We also noted a systematic gap between what randomized trials show and what observational studies suggest. RCTs almost universally report no effect on major cardiovascular events or mortality.^[22, 29, 31, 33, 40, 42, 46, 47, 49, 50, 55] Yet, observational cohorts often point to strong protective benefits for attendees, particularly among older adults or those with cardiometabolic risks.^[63, 67, 69, 71, 72, 77, 78] A similar pattern was seen for health behaviors: RCTs demonstrated little to no impact on smoking or hazardous alcohol use,^[30, 35, 38, 41, 44, 46, 47, 50] while observational evidence reported lower smoking prevalence and improved drinking patterns among attendees.^[64, 75] These discrepancies likely stem from residual confounding, the "healthy user effect," and socioeconomic factors that influence who chooses to attend. As a result, observational studies probably overstate the causal benefits of GHCs, meaning RCT data should remain the gold standard for judging their true efficacy in the general public.

Crucially, several studies reported adverse or ambivalent findings. In the A Healthy Future trial,^[46] mortality was higher among intervention participants aged 75 years or older compared with controls; however, a subsequent analysis attributed this difference largely to greater use of advance directives and less life-prolonging treatment at the end of life,^[45] raising questions about goal-concordant rather than iatrogenic harm. In the Inter99 trial,^[57] women in intervention areas with high participation had higher all-cause mortality, and investigators hypothesized that widespread use of nutritional supplements might

have contributed to smoking-related cancers, although this remains uncertain. In the DanMONICA trial,^[49] invitation to repeated health checks was associated with a higher long-term incidence of stroke, which the authors linked to potential mechanisms including overdiagnosis, overtreatment, or adverse psychological responses. In contrast, the VIVA trial^[40] showed reduced all-cause mortality but more hospital days for chronic obstructive pulmonary disease and stroke or transient ischaemic attack in the screened group, suggesting that more intensive detection and treatment may simultaneously increase health care use and mediate survival gains. Consistent with this, the increased hospitalization observed in older women in another trial was primarily driven by surgery and gynecology services, reflecting a rise in necessary therapeutic interventions following early diagnosis rather than a worsening of health status.^[22] Additionally, a large nationwide cohort from Taiwan found that while depression screening reduced overall psychiatric hospitalization, it was associated with a modestly increased risk of suicide among older adults.^[62] This excess risk was concentrated shortly after the health check, leading authors to suggest that newly disclosed severe diagnoses or health concerns in older adults might transiently heighten psychological distress. These findings emphasize that the potential for adverse effects, particularly in older or vulnerable populations, must be monitored.

Our evidence base distinguishes itself by being both comprehensive and current. We incorporated a wide array of designs, ranging from formal economic evaluations to randomized and observational trials, across multiple countries and healthcare systems. By synthesizing outcomes across the full continuum of mortality, major cardiovascular events, and risk factor control to health-care utilization, health behaviors, and patient-reported, psychological, and economic outcomes, we provide a more integrated picture of the impact of general health checks than prior reviews. We also introduced necessary nuance by explicitly contrasting results in unselected adults against those in older or high-risk groups. Additionally, by integrating frequently neglected areas like mental health and cost-effectiveness, the analysis addresses gaps left by earlier research. Finally, the inclusion of large-scale studies with long-term follow-up strengthens the temporal validity of our findings.

This study also has important limitations. First, significant heterogeneity in the definition and components of "general health check," as well as in study populations and settings, limited our ability to perform meta-analyses. Second, many of the randomized trials were conducted decades ago, before the widespread use of statins, contemporary antihypertensive regimens, structured multifactorial cardiovascular risk management, and current cancer screening practices. As a result, it may reduce the applicability of some findings to current practice. Third, although randomized trials provide the most reliable evidence on mortality and cardiovascular events, our conclusions for several domains, particularly health behaviors, psychological outcomes, and economic outcomes, also rely on observational studies that are vulnerable to residual confounding, healthy-user effects, and selective participation. Fourth, outcome definitions, measurement methods, and follow-up durations varied across studies; many behavioral, quality-of-life, and psychological outcomes were self-reported, increasing the risk of measurement bias. Finally, we included only studies published in English or Chinese. Despite comprehensive searching and inclusion of unpublished data where available, we cannot rule out

language or publication bias or selective outcome reporting, especially for smaller studies and for outcomes such as psychological harms and costs.

5. Conclusions

In this comprehensive systematic review, we found no consistent evidence from randomized trials that general health checks reduce mortality, major cardiovascular events, or hospitalizations. By contrast, general health checks were regularly associated with earlier detection of chronic conditions, modest improvements in cardiovascular risk factor control, greater uptake of preventive services and pharmacotherapy, and small gains in patient-reported and psychological outcomes, alongside generally favorable economic profiles. Because we included new data from a variety of settings, including developing nations, these benefits appear to hold relevance for global health rather than being limited to Western populations. Looking across the data, potential survival benefits are more apparent in older adults or individuals at elevated cardiovascular risk, whereas universal, low-intensity checks in unselected adults yield limited clinical benefit. A small number of studies also reported adverse or ambivalent findings, underscoring the need to monitor unintended consequences. Therefore, the data argues against a one-size-fits-all model. Instead, GHCs should be viewed as a key element of a proactive health strategy. To ensure both economic sustainability and clinical utility, implementation must shift toward risk-stratified, integrated care that prioritizes high-risk groups and older adults.

Abbreviations

GHCs

General health checks

MeSH

Medical Subject Heading

RCTs

Randomized controlled trials

NRCTs

Nonrandomized controlled trials

Declarations

Ethics approval and consent to participate:

Ethical approval and consent to participate was not required for this systematic review.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

YW: Conceptualization; Methodology; Writing—original draft; Data curation; Investigation; Formal analysis; Writing—review & editing. QZ: Conceptualization; Methodology; Data curation; Formal analysis; Writing—review & editing. XZ: Conceptualization; Methodology; Data curation; Formal analysis; Writing—review & editing. LW: Supervision; Writing—review & editing. LHX: Supervision; Writing—review & editing. QL: Supervision; Writing—review & editing. TBY: Supervision; Methodology; Writing—review & editing. JL: Funding Acquisition; Project Administration; Supervision; Writing—review & editing. All authors read and approved the final manuscript.

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Data Availability

Data is provided within the manuscript or additional information files. Any additional datasets used during the current study are available from the corresponding author on reasonable request.

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Figures

PRISMA 2020 flow diagram for updated systematic reviews which included searches of databases and registers only

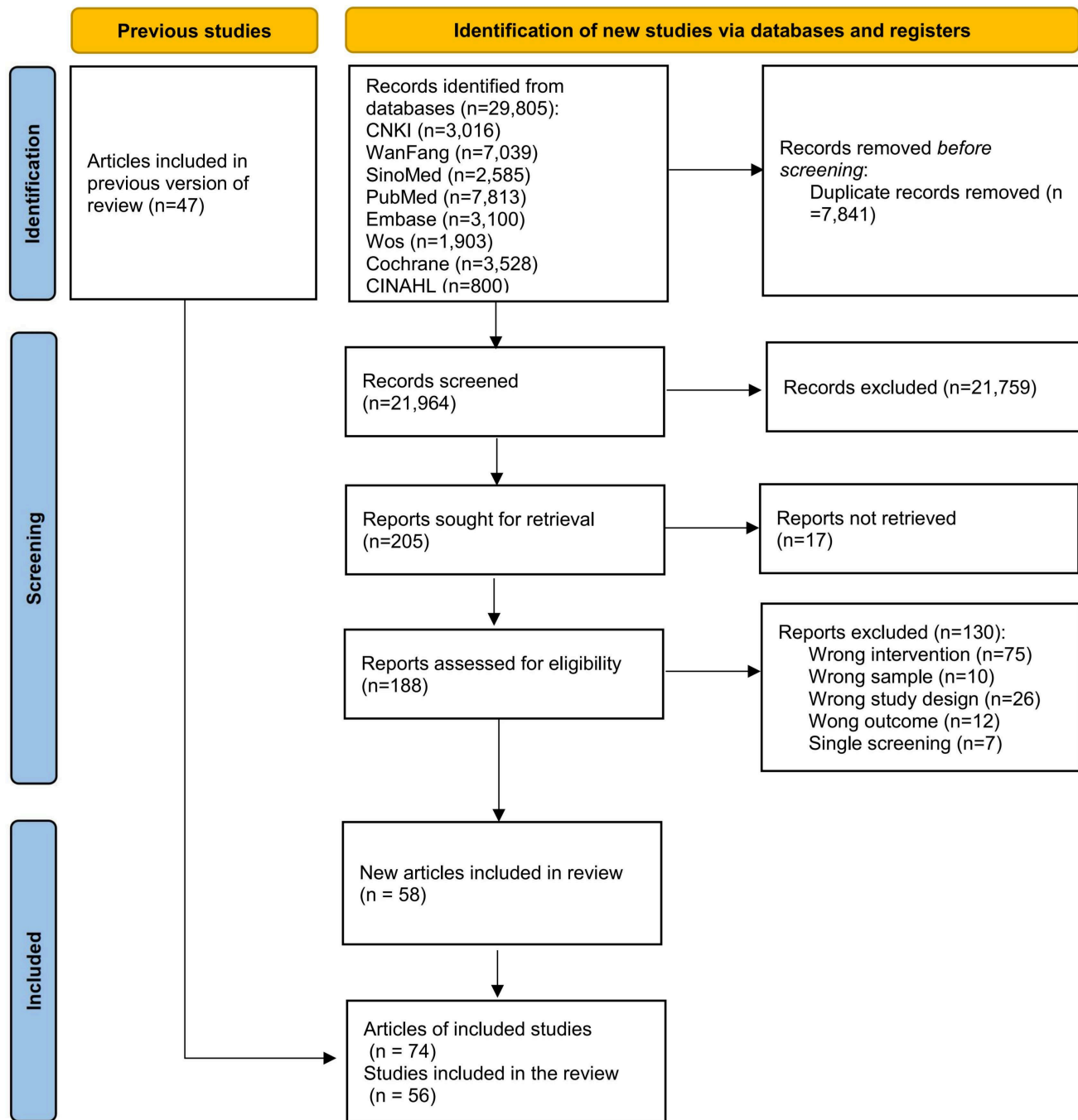


Figure 1

Flowchart of Study Selection

Global distribution map of number of studies
Display the number of studies by country

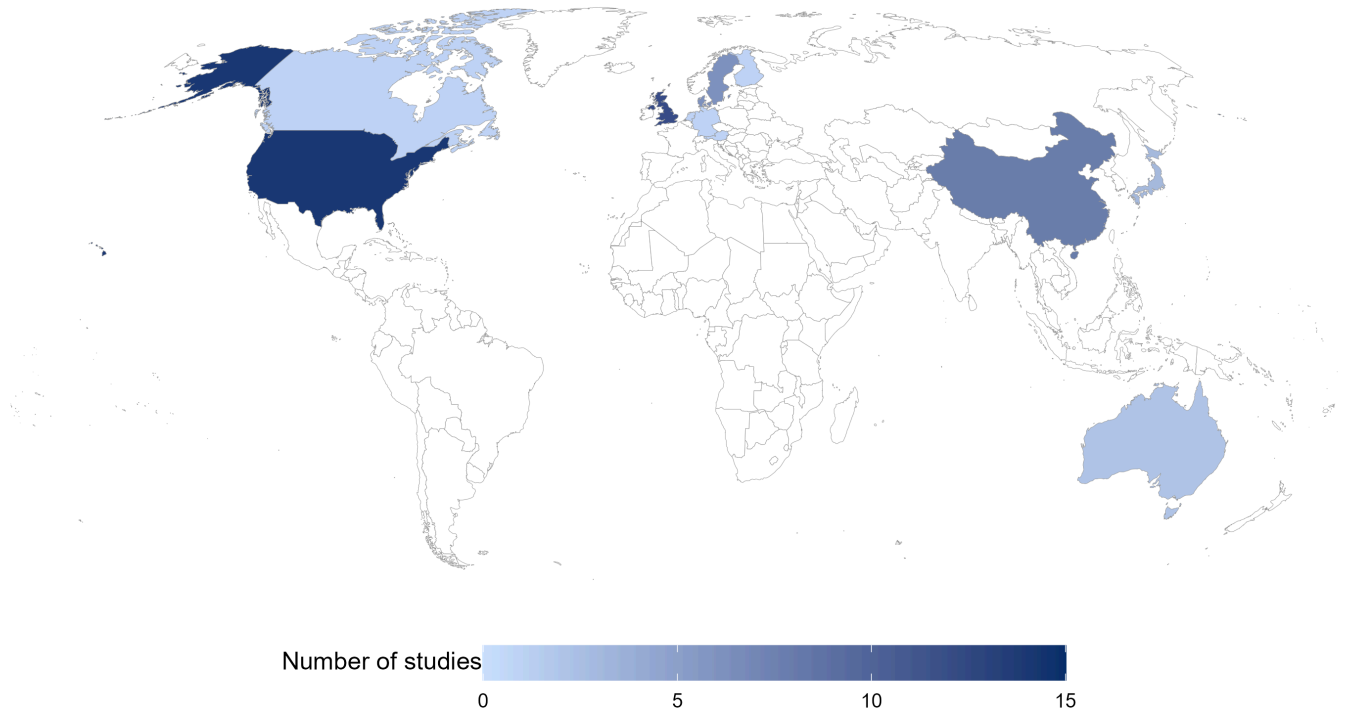


Figure 2
Global Distribution and Number of Included Studies by Country

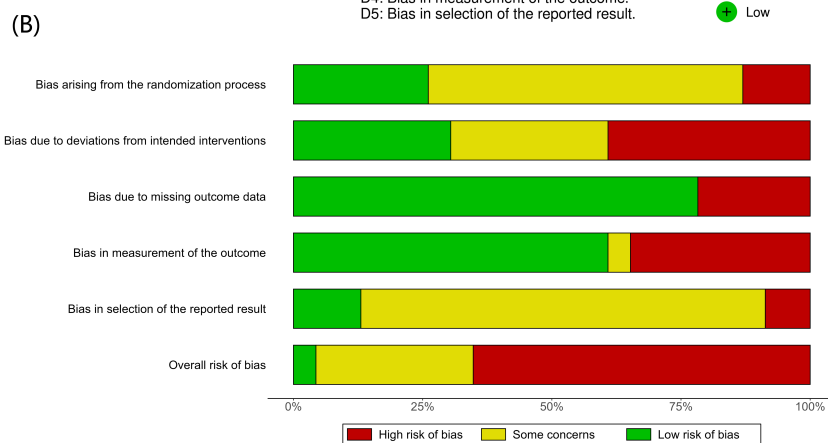
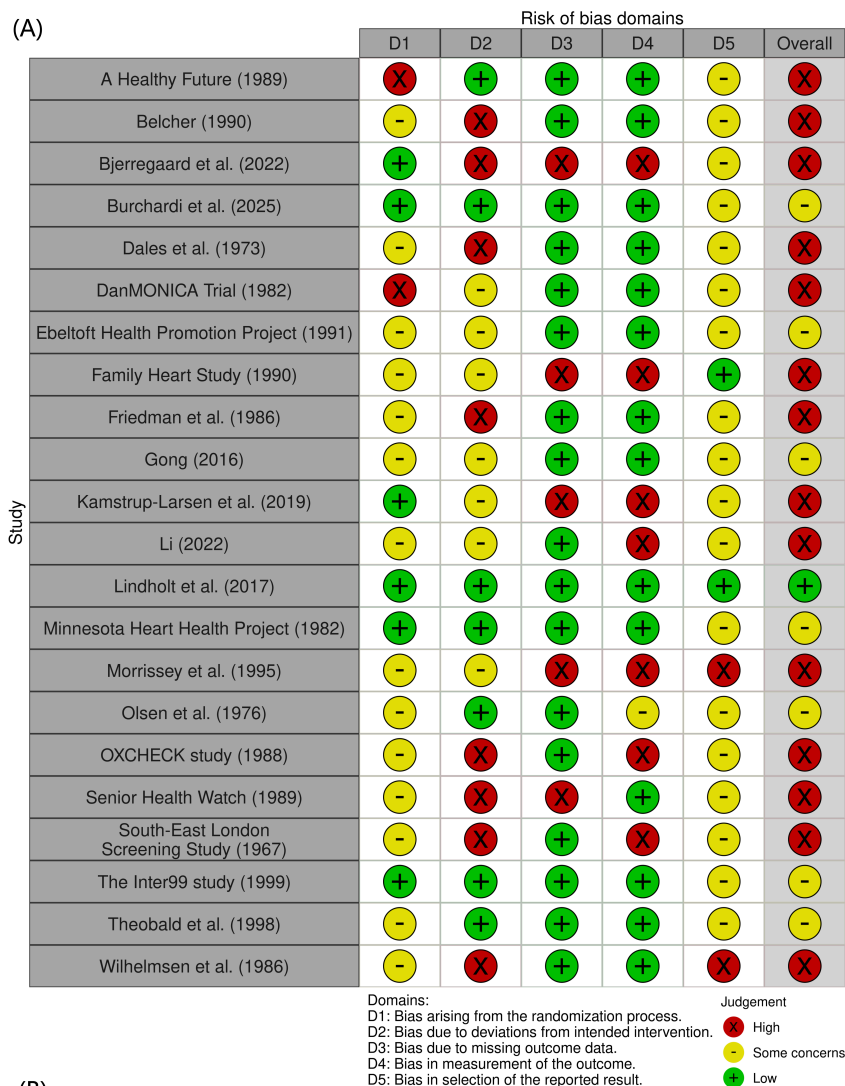


Figure 3

Risk of Bias in Randomized Controlled Trials of General Health Checks

(A) Study-level overall risk-of-bias judgments for each randomized controlled trial.

(B) Domain-specific distribution of risk-of-bias judgments across all randomized controlled trials.

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