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Title: Effects of telephone consultation on safety, service use, patient satisfaction and workload: Systematic review and meta-analysis of randomized trials

Abstract

Objective: Telephone consultation (TC) were widely used for its easy access and convenience. This review aimed to assess the effects of TC including triage on safety, service use, patient satisfaction, and health professionals' workload to inform directions for future health service practice.

Methods: CENTRAL, MEDLINE, Embase, CINAHL, ProQuest Dissertation & Theses (Health & Medicine), ClinincalTrials.gov, and International Clinical Trial Registry Platform were searched on 7 April 2022. The included were randomized controlled trials that compared TC with standard (faceto-face [F2F]) management or that by another group of call advisers. Cochrane methods were used to select eligible studies, assess the risk of bias, estimate summary effect measure, and grade evidence certainty. Meta-analysis was performed on important outcomes with moderate- or high-quality evidence.

Results: Eight studies were included involving 40,002 participants. TC could increase call resolution—proportion of callers' concerns being addressed by telephone advice alone (two studies; high certainty) and reduce F2F contacts with doctors for the first consultation (two studies, moderate certainty certainty) compared with standard management or TC by doctors. None of included studies reported increases in adverse events, including all-cause mortality, acute and emergency department visit, and hospitalization. There was inadequate evidence regarding the effects of TC on patient satisfaction and length of consultation.

Conclusion: The findings support the benefits of TC on improving call resolution and reducing F2F contacts with doctors on the day of first management for regular day service; and TC by nurses can provide better effects than that by doctors for out-of-hours service.

Keywords: call resolution, remote consultation, triage, telephone consultation, primary health care, health service research, telemedicine

MAIN TEXT

1 | INTRODUCTION

The rapid growth of information and communication technology and contact-limiting conditions (e.g., the COVID-19 pandemic) has accelerated the use of telemedicine. Telephone consultation (TC) is regarded as the most common alternative choice of telemedicine to face-to-face (F2F) consultation for its easy access and convenience.¹ TC is a process through which patient health problems are received, assessed, and managed by telephone advice or referral to a more appropriate service.² TC services (TCs) offer an additional source of help and advice within or out of (working) hours, many of which operate on the platform containing different algorithms to manage calls and help patients self-manage problems or redirect them to more appropriate services.

TCs grow rapidly to better address patients' and care providers' demands for emergency and safe care without increasing unnecessary use of ambulances, primary health care, or hospital acute and emergency (A&E) care.^{3,4} Such services can be provided by individual practices, practice cooperatives, or national health authorities, while telephone/call advisors are often part of a multidisciplinary team—including nurses, doctors, pharmacists, and paramedics—with or without access to decision-support systems or computerized algorithms.⁴

2 | THE REVIEW

Although TCs aim to relieve the burden on general practice and hospital A&E, there remains little evidence about TCs reducing the pressure on health services. The initial introduction of doctor TC in Denmark showed a substantial reduction of home visits by 28%.⁵ However, a more recent study found that a high percentage of out-of-hours calls (12.7% of those receiving clinical consultation and 11.7% of those receiving home visits) actually did not

require F2F contact with primary care physicians (PCPs) including general practitioners (GPs).⁶

This indicates the room to further reduce the unnecessary F2F contact with PCPs. The introduction of National Health Service (NHS) Direct in the United Kingdom showed a small decrease in out-of-hours contact with GPs but not in the use of A&E or ambulance care.⁷ A later study revealed that about one in four NHS Direct callers across a 4-month period was referred to A&E, ambulance, or other out-of-hours services.⁸ It means that there was a high potential (for such 25% of calls) to further relieve the burden on health services.

TCs are alternative choices of health care different from standard F2F management. Patients' experiences and perceptions play important roles in the provision and sustainability of the services. There are many other factors (e.g., age, socioeconomic status, ethnicity, gender) that may influence patient satisfaction with TCs. Patients with certain disadvantaging characteristics (e.g., female, > 65 or < 5 years, ethnic minority, migrant identity, and poverty) are often the most frequent users of TCs and other out-of-hours services.⁹⁻¹³ Unsafe or ineffective TC services would aggravate the vulnerability of these patients and deteriorate their health status. Although many studies found TC services to be safe and effective,^{3,10,14} concerns about the quality, safety, and impact of TCs persist.^{4,15,16}

What's more, doctors' workload is key to the quality and patient experience of health care; a heavier workload is associated with poorer quality of care and lower patient satisfaction.¹⁷ However, there remains a lack of evidence about the effect of alternative workforces (e.g., nurses and paramedics) of TC in replace of doctors' consultation.¹⁸ We thereby were very interested in the impact of different groups of caregivers TCs on the workload of health professionals especially PCPs, which was not investigated in the original Cochrane review.¹⁹

This review started as an update of the Cochrane review by Bunn et al. by using the

most recent technique to synthesize existing evidence about the impact of TCs.¹⁹ We believed that the pooled data would help generate a better understanding of TC within the context of various TCs world-widely and inspire future directions for health care providers to make changes so to enhance contribution to primary health care and public health services.

3 | AIMS

The primary aim of this review is to assess the effects of TCs on safety, service usage, patient satisfaction, and healthcare professionals' workload. We intended to compare TCs with standard (F2F-based) management of calls or another telephone service by different groups of caregivers.

4 | METHODS

4.1 Design

This study is a systematic review and meta-analysis of randomized trials (RTs) following the PRISMA 2020 checklist. This systematic review was not registered, but the initial protocol is accessible (<https://doi.org/10.6084/m9.figshare.23851044.v1>).

4.2 Search methods

Search strategies were developed based on the review by Bunn et al. by consulting an Information Specialist (PM) (Supplemental material 1).¹⁹ On April 7, 2022, the strategies were applied in search of two registries (World Health Organization International Clinical Trials Registry Platform and ClinicalTrials.gov) and four databases (Cochrane Central Register of Controlled Trials, MEDLINE, Embase, CINAHL, and ProQuest Dissertation & Theses (Health & Medicine)).

We applied the search to an additional database of ProQuest Dissertation & Theses to locate more relevant reports. The reference lists of included studies and relevant systematic reviews were checked to locate more eligible studies. There was no language limitation. We limited the search of records added since 2007 when was the last search for the original

review and contacted authors and experts on reviewed topics or Cochrane Effective Practice and Organisation of Care (EPOC) interventions.¹⁹

4.3 Inclusion and exclusion criteria

The study population was those in areas with potential access to TC lines. All designated TC systems were of interest where patient calls were received, assessed, and managed through the provision of advice or referral to a more appropriate service.²

The following comparisons were considered to capture the modes of care provision and the categories of call advisors: (1) TC by any health professionals for the first/ index consultation followed by F2F consultation when appropriate versus standard management (e.g., F2F contact alone); (2) TC provided by one group of health professionals versus that by another group of health professionals (e.g., nurse TC versus doctor TC); and (3) TC by the same group of health professionals with the access to computerized algorithms versus that without the access (e.g., TC by NHS Direct nurses versus that by practice-based nurses).

The following interventions were excluded: (1) TCs not done as part of a designated TC system (e.g., telephone advice given by GPs as part of their usual work); (2) Telephone lines centered on specific illness (e.g., diabetes) or just for self-help or support (e.g., weight control). Disease-specific TCs tend to be information oriented instead of consultation focused. Including such TCs thereby would make the review too diverse, and it would be very difficult to prespecify all important disease-specific outcomes; and (3) TCs not given directly to the patients or their carers who made the call.

4.4 Search outcome

Primary outcomes included (1) call resolution: proportion of patients or callers who received telephone advice alone to address their concerns without any further F2F contact with health professionals;³ (2) index-day PCP contact F2F: proportion of patients who received F2F consultation provided by a doctor at primary care settings (e.g., surgery, home visit, and

walking centers) on the day of the first/index contact; (3) subsequent PCP contacts: number of various encounters with PCPs during emergency visits, routine appointments, home visits, and out-of-hours care within up to 1-month follow-up; (4) adverse events (AEs): proportion of all-cause mortality, A&E visit and hospitalization within up to 1-year follow-up; and (5) patient satisfaction: patient experience and perception of the care received on the day of index consultation as assessed by questionnaire survey or individual interviews.

Secondary outcomes were mainly related to health professionals' workload and the entailed cost, including (1) length of consultation: time duration for the index consultation; (2) cost to patients (e.g., medications) and care providers (e.g., practice resources and training for the provision of TCs, and health professionals' time for index and subsequent consultations when appropriate within up to 1-month follow-up).

We only included RTs and excluded non-RTs, controlled before-after studies, and interrupted time series, to restrict the evidence to high-quality studies. Two review authors (YLZ and TL) independently applied the above selection criteria to examine the titles and abstracts of citations identified through electronic and manual searches. We retrieved all full-text reports of possible relevant studies and resolved disagreements by engaging the third author (SYC or WTC) in discussions.

4.5 Quality appraisal

Two authors (YLZ and TL) independently applied the recommended tools and criteria to assess the risk of bias (RoB) on each of the aforementioned outcomes for every included study and grade the certainty of evidence on each outcome across included studies. The third author (SYC or WTC) joined the discussion to resolve disagreements.

The revised Cochrane risk of bias tools for RTs (i.e., RoB 2) and cluster-RTs (i.e., RoB 2 cluster-randomized trial) was used to assess the domain bias arising from randomization process (D1),^{20,21} deviations from intended interventions (D2), missing

outcome data (D3), outcome measurement (D4), and selection of reported result (D5), respectively.²² An overall RoB was judged based on the scale of domain biases: ‘low’ for all domain biases as ‘low risk’, ‘high’ for any domain bias as ‘high risk’ or having multiple domain bias as ‘some concerns’ (> 2), and ‘some concerns’ for the remaining conditions regarding domain bias.^{20,21}

The approach for the Grading of Recommendations, Assessment, Development and Evaluations was adopted to rate the certainty of evidence on each specified outcome for synthesis of data across studies.²³ The certainty of evidence may be graded as ‘high’, ‘moderate’, ‘low’ and ‘very low’, depending on the impact of RoB, imprecision, inconsistency, indirectness and publication bias on the confidence of the findings. We degraded or upgraded the certainty of evidence by one or two levels according to the suggested criteria in each of these impactful areas.²⁴

4.6 Data extraction

Two authors (YLZ and TL) independently extracted information by referring to the suggested items for EPOC review data collection. Data collected covered every aspect of study methods, including settings and participant characteristics, randomization process, unit of allocation and analysis, intervention details, outcome measurements, follow-ups and attrition, data completeness and reporting.

We also contacted the authors of newly included studies in this review for details of missing data and for clarification of reported data. The Cochrane Collaboration’s Review Manager (RevMan 5.4) was used to manage the data, while a “Summary of findings” table for specified comparisons was prepared according to relevant guidelines.²²

4.7 Synthesis

We adopted the intention-to-treat analysis strategy to synthesize data on each outcome following the guidelines of Cochrane and using the RevMan 5.4.²² Given the inclusion of

cluster-RTs, their effective sample sizes were adjusted by accounting design effects based on intraclass correlation coefficients (ICCs) estimated from similar studies. For multiple-arm RTs, ^{25,26} intervention groups were combined together or compared with each other for further analysis.

In consideration of variation of interventions of the included studies, the random effects model was used for data synthesis. ²² For continuous outcomes (i.e., length of consultation), the generic inverse variance method was used to estimate pooled mean difference (MD, 95% confidence interval (CI)) across studies. For dichotomous outcomes (i.e., call resolution and index-day F2F contact with PCPs), the Mantel–Haenszel method was used to estimate risk ratio (RR, 95% CI). The I^2 statistic was used to quantify the heterogeneity across studies with I^2 of 50% and above indicating substantial or considerable heterogeneity.

For outcomes (i.e., AEs, patient satisfaction, PCP contacts, and cost) with different measures a narrative review was performed. Subgroup analyses were conducted by grouping studies according to call adviser (nurses or doctors) and TC service hours (within- or out-of-hours) to examine the heterogeneity between subgroups. Sensitivity analysis was conducted by excluding studies of doctor-TC to see whether the finding would be different. Funnel plot analysis was not executed to examine the reporting bias given fewer studies than the suggested criteria of 10 for a reasonable analysis. ²²

5 | RESULTS

5.1 Study selection

Our search generated 4,608 references after the removal of duplicates (see PRISMA flow diagram in Figure 1). We excluded 4,577 records based on the title and abstract and then retrieved 28 full texts for further evaluation. Nineteen studies (see Supplemental material 2) were excluded because of inappropriate population (n=2), study design (n=6), intervention

(n=3), outcomes (n=6), and study protocol (n=2).

Finally, eight studies were included in this review, of which seven studies can be traced back to the original review¹⁹ where five studies had been included,^{2,26-29} while the other two emerged from the ongoing ones.^{30,31} One of the included had a full report,³² while the other study had cost investigation reported separately.³³

5.2 Study Characteristics

Five studies were cluster RTs using practice,²⁵ physician team,²⁶ or time-block^{2,29,30} as the cluster/unit for allocation. The other three were parallel RTs.^{27,28,31}

Six UK studies were conducted at general practices, while two US studies occurred at the university facilities or veteran service only involving male patients.^{26,28} Participants (n=40,002, sample size 210 to 20,990) were mainly from disadvantaged groups, either living in deprived areas or belonging to a population at lower social status (see Table 1).

Five studies targeted calls initiated during office hours (i.e., within-hours service) for same-day care. One of three studies about calls beyond working hours examined all out-of-hours calls for > 2 years;²⁶ The other two out-of-hours service studies were conducted by the same team, one of which only focused on overnight-hours calls for 1 month,²⁹ while the other on evening and weekend calls for ~ 1 year.²

Three comparisons were clearly identified according to the pre-specified distinguishing characteristics between the TC intervention and the control/ comparator. Five studies compared TC with usual practice where normal F2F-based consultation was provided (i.e., Comparison I),^{25-28,31} one of which involved trained clinical clerk instead of health professionals in the delivery of TC.²⁸

The second comparison (Comparison II) was observed in three studies where TC was provided by trained practice nurses compared with that provided by doctors (predominately GPs).^{2,29,30} Only one study was found to have compared TCs provided by two groups of

nurses working for the NHS Direct (with the aid of an algorithm) versus general practices (with the access to usual clinical protocols but not the algorithm).³⁰ More details about the interventions were provided in Table 2 according to the reporting guidelines.^{22,34}

5.3 Risk of bias in studies

None of the trials was at a low RoB on all outcomes. Two cluster-RTs had a high RoB on all outcomes; For the remaining six trials, there was at least one RoB domain to be considered as having ‘some concerns’ on any measured outcome.^{25,30} The risk of bias mainly arose from randomization process (e.g., concealment) and outcome measurements (e.g., varied measure points, different tools, and assessment methods). The lack of registration or study protocol for four trials was the major source of bias leading to the selection of the reported result.^{26-28,30} See the traffic light plots of RoB on each outcome in Figure 2.

5.4 Effects of TC intervention

Table 3 summarizes findings about the effect of TC compared with the control. Only one cluster-RT reported the ICCs on primary care contacts (ICC = 0.015),²⁵ AEs (ICC = 0.022) and patient satisfaction (ICC = 0.013). We thus used these ICCs to adjust the effective sample sizes for all the other cluster-RTs^{2,26,29,30} according to the guidelines of Cochrane.²² Meta-analysis was only performed on call resolution and index-day PCP contact F2F but not on length of consultation given considerable heterogeneity.

5.4.1 TC versus Standard management

One of five trials (20,392 participants) was about out-of-hours care,²⁶ while the others were about within-hours care.^{25,27,28,31}

Call resolution. Three trials did not report any participant in standard management who received telephone advice (adjusted 2,033 participants).²⁶⁻²⁸ For two studies about within-hours contacts,^{25,31} meta-analysis shows that TC may improve call resolution more than

standard management (RR 14.33, 95% CI 7.87 to 26.07, $I^2 = 0\%$; two trials, adjusted 2,766 participants, high certainty of evidence, Figure 3.A1a).

Index-day PCP contacts F2F. The reduction of F2F contacts with PCPs in proportion was consistent across three trials.^{25,27,31} Meta-analysis shows that TC could lead to significant reduction in F2F contact with PCPs for the first consultation (RR 0.40, 95% CI 0.23 to 0.68; $I^2 = 97\%$; adjusted 5,234 participants, moderate certainty of evidence) (Figure 3.A2).

Subsequent PCP contacts. Categories or specific types of contacts with primary care involving the contacts with PCPs F2F or by phone within- or out-of-hours were assessed in three RTs (adjusted 3,155 participants, very low certainty of evidence) within two-week or 28-day follow-up.^{25,27,31} Either reduced contacts or little to no change effect was observed, suggesting non-inferiority of nurse-TC to doctor-TC.

Adverse Events. Meta-analysis deems inappropriate given the heterogeneity in defining adverse events in the included studies. Five trials reported AEs within seven-day up to one-year follow-up (20,158 participants; very low certainty of evidence).^{25-28,31} Only one of five studies did not examine the effect on A&E or hospital admission.^{27,28} No negative effect (i.e., increased A&E or hospital admission) was detected. The only study of all-cause mortality was not powered to detect any effect.²⁵

Patient satisfaction. One trial only reported this outcome among TC participants.²⁶ Three trials assessed patient satisfaction using different instruments (adjusted 2,919 participants, very low certainty of evidence).^{25,27,28} The cluster-RT revealed greater dissatisfaction among TC participants, though the proportion of those reporting ‘very or fairly satisfied’ with the care on the day of first contact was approximately 90% (89.2% vs. 91.2%; adjusted 1,970 participants).²⁵ No significant group difference in patient satisfaction was found in the other two studies.^{27,28}

Length of consultation. One trial measured this outcome but only reported total contact time with GPs and nurses within 28-day follow-up.³¹ Two trials consistently revealed shorter consultation for the first management in TC group versus standard management (MD -3.32, 95% CI -5.56 to -1.08; $I^2 = 97\%$; adjusted 2854 participants, moderate certainty of evidence)^{25,27} (see Figure 3.C).

Costs. Different outcomes (e.g., index-day primary care cost, 28-day drug cost) were assessed in two trials.^{25,31} Both estimated the cost for doctor and nurse time within 28 days of follow-up (adjusted 4,005 participants; very low certainty of evidence) and did not find group difference. One of them also reported non-significant difference in prescription cost.³¹ The other detected significant reduction in total contact cost on the day of first management in TC group.²⁵

5.4.2 Nurse-TC versus doctor-TC

Three cluster-RTs compared TC provided by nurses versus that by GPs.^{2,25,29}

Call resolution. Meta-analysis about out-of-hours care shows that, compared with the delegating service (doctor-TC first),^{2,29} TC provided by nurses likely increased call resolution (RR 1.31, 95% CI 1.26 to 1.37, $I^2 = 0\%$; 10,344 participants, adjusted 7,575 calls; moderate certainty of evidence, Figure 3.B1). This is in contrast with reduced likeliness as revealed in the study of within-hours care²⁵ (RR 0.37, 95% CI 0.27 to 0.49; adjusted 1,778 participants; some concerns, Figure 3.B1).

Index-day PCP contact F2F. Two trials compared nurse-TC handled calls for out-of-hours care versus that by delegated GPs that were managed by F2F contact with GPs at surgery or at home on the day of a call.^{2,29} Meta-analysis shows that in 1,000 participants, 155 fewer probably lead to F2F contact with PCPs for the first consultation (adjusted 7,575 calls, RR 0.69, 95% CI 0.65 to 0.73; $I^2 = 0\%$; moderate certainty of evidence). This is different from the finding about within-hours contacts²⁵: More nurse-TC participants had F2F contact with

PCPs than those in doctor-TC group (adjusted 2,425 participants, RR 1.55, 95% CI 1.41 to 1.71) (see Figure 3.B2).

Subsequent contacts. Two trials (1,738 participants, very low certainty of evidence) reported subsequent contacts with primary care in rate or mean/patient.^{25,29} Neither identified a significant difference in PCP contacts F2F, within three-day or 28-day follow-up.^{25,29}

Adverse events. Three trials (adjusted 5,487 participants; very low certainty of evidence) examined the effect of nurse-TC versus doctor-TC on AEs within 24-hour up to 28-day follow-up for within-hours care or out-of-hours care.^{2,25,29} None of them revealed any negative effect in this outcome domain, that is, no increased A&E, hospital admission, or all-cause mortality.

Patient satisfaction. One trial revealed greater dissatisfaction among nurse-TC participants with the care on the day of first consultation than those in doctor-TC group (adjusted 1,289 participants, MD 2.60, 95% CI 0.58 to 4.63, 1289 participants, high RoB).²⁵

Length of consultation. Only one trial reported the duration of the first management, showing a longer length of consultation for TC participants than those in doctor-TC (MD 2.60, 95% CI 2.27 to 2.93; adjusted 1,570 participants, some concerns risk).²⁵

Costs. Two RTs estimated the cost within 28 days of contact²⁵ or across a whole year³³ at practices and for doctor and nurse time (adjusted 6,593 participants; very low certainty of evidence). One did not identify significant differences in practice costs for staffing, management, and other resources nor cost for primary care contacts.²⁵

The other extrapolated significant saving per annum (£ 29,483 in total) in nurse-TC for out-of-hours care, attributable to reduced emergency admission, traveling for home visits, and surgery attendance within three days of contact.³³ The study for within-hours care found higher cost in nurse-TC versus doctor-TC on the index day of contact (adjusted 1,602 participants, adjusted mean/person £ 3.17, 95% CI 0.03 to 6.31).²⁵

5.4.3 Nurse-TC with an algorithm versus without the access

One cluster-RT³⁰ compared TC by NHS Direct nurse advisers (with access to the algorithm but no access to patient records) versus that by practice-based nurses (with access to clinical protocols but no access to the algorithm) (adjusted 1,798 participants; high RoB). It found that NHS Direct participants were less likely to have their concerns resolved by telephone advice alone.

Participants had significantly longer (in minute) thereby higher cost (MD £1.66, 95% CI 1.40 to 1.93, with the control of the final point of contact) contact with nurses on the day of appointment request in TC group. No other differences (with the control of final contact) were found regarding practice-based (i.e., GP time, medications, radiography, and tests), A&E, and out-of-hours contact and related cost. Other outcomes (mortality, hospital admission and patient satisfaction) were not reported.

5.4.4 Subgroup analysis

Subgroup analysis shows little to no difference in length of consultation ($P = 0.05$, $I^2 = 73.9\%$) between the subgroup using screen time²⁵ and that stopwatch-time²⁷ as the measurement, and in index-day PCP contact F2F between the subgroup of nurse-TC^{25,31} and doctor-TC^{25,27} versus standard management (see Supplemental material 3). As to the comparison of nurse-TC versus doctor-TC, a significant difference was found in call resolution ($P < 0.001$; $I^2 = 98.7\%$) and index-day PCP contacts F2F ($P < 0.001$; $I^2 = 99.5\%$) between the subgroup for within-hours care²⁵ and that for out-of-hours care.^{2,29} See more in Figure 3 B1 & B2.

5.4.5 Sensitivity analysis by nurse-TC versus standard management

By only using nurse-TC group data in comparison with standard management,^{25,31} sensitivity analysis shows that the effect on call resolution is still significant but on a smaller scale (RR = 10.25, 95% CI 5.57 to 18.86; $P < 0.001$, $I^2 = 0\%$). See more in Figure 3 A1b.

6 | DISCUSSION

Obviously, the certainty of evidence across included studies on certain outcomes or outcome domains was compromised mainly by ‘some concerns’ or ‘high’ risk of bias for individual studies and inconsistency in the measurement of related outcomes.

6.1 Quality of the evidence

The heterogeneity (e.g., varied TC working hours, different assessment tools and effect measures, and multiple follow-up periods) and methodological weakness (i.e., multiple risk domains as ‘some concerns’, lack of pre-specified protocol) are obvious for included studies. This threatens the certainty of evidence, leading to the scarcity of high and moderate certainty of evidence on specified outcomes and limiting our confidence in interpreting the findings of this review.

6.2 Summary of findings by comparisons

Compared with standard management, there is high quality evidence supporting the positive effect of TC on addressing callers’ healthcare concerns simply by giving telephone advice. We’re at moderate confidence that TC may reduce the proportion of patients who require going to see doctor F2F to solve their health problems by more than one fourth (95% CI lower 296 to upper 712 per 1000). The evidence is very uncertain about all the other findings regarding whether TC increases or reduces subsequent contacts with PCPs following the first consultation, AEs, patient satisfaction, cost, and length of consultation.

The quality of evidence about TC versus standard management was more and better than about the comparison between nurse-TC versus doctor-TC. For the latter comparison, two studies used calls as the unit of analysis without indicating the number of participants,^{2,29} which made data synthesis beyond themselves very difficult as usually it is participants as the unit of analysis. Our subgroup analysis clearly showed the heterogeneity of data between these two studies and the other one.²⁵

We can say that there is moderate evidence about the effect of nurse-TC for out-of-hours services that probably increases the proportion of participants to have their problems solved by telephone advice alone by over 10% compared with doctor-TC (13% to 18.5% of calls at 95% CI) and reduces the proportion of calls to see doctors F2F by 13.5% to 17.5% of calls (95% CI). There is no certain evidence about the effect of nurse-TC on other outcomes related to PCP contacts, AEs, cost, and patient satisfaction for contacts during or out of regular hours.

The only study comparing TCs by two different groups of nurses suffered from the compromised randomization process (i.e., predictability of assignment), seriously weakening the evidence about nurse-TC.³⁰

6.3 Agreements and disagreements with other studies or reviews

Boggan et al. examined the effectiveness of remote triage systems for acute care and found a high rate of case resolution in TC group — without explicating the comparator.³ This is consistent with our finding regarding the higher call resolution among TC participants in the comparison of TC versus standard management and nurse-TC versus doctor-TC, respectively. Although inconsistency remains regarding the evidence about whether TC increases or reduces PCP workload in terms of contacts with PCPs,^{3,35,36} we have moderate confidence that TC probably reduces the index-day PCP contacts F2F compared with standard management.

The economic estimation about TC related expenditure was mainly based on contacts with PCPs (i.e., doctors and nurses) in terms of number and duration of contacts. Addition categories of cost are related to practice contribution, A&E visit, hospitalization, and patient care (e.g., medication, tests, and imaging).^{25,30,31,33} Although there is no certain evidence about whether TC increases the cost, it is consistent that there was reduced index-

day cost (estimated by PCPs time and standard unit cost) and there was little to no change to total TC-related cost within 28-day up to one-year follow-up period in any comparison.

In fact, it is quite difficult to interpret the impact of TC on the time duration for the first consultation. Irving et al identified a wide range of time periods (48 seconds to 22.5 minutes) for the first consultation and estimated that about half of the global population spent five minutes or less with their PCPs.³⁷ Our evidence about reduced length of consultation in TC group compared with standard measurement is challenged by substantial heterogeneity — probably caused by different time measures (stopwatch time or screentime). Some studies found that patients favour longer and more timely contacts with GPs F2F.¹⁷ More studies thereby are required to further investigate the impact of patient preference on the length of consultation with doctors or/ and other caregivers.

Huibers et al identified a wide variety of adverse effects of TC for out-of-hours care beyond AEs;³⁸ For instance, medical errors, inappropriate dispatch to a lower level of care, delayed treatment, clinical harm (e.g., pain), and risk incidents (e.g., documentation errors). Although uncertain about the evidence on AEs, we did not find any evidence regarding the negative impact of TC in any specified comparison (i.e., not increase the incidence of AEs). To be conservative, we do not have confidence to affirm or refute that TC for within- or out-of-hours care appeared to be safe.^{3,4,14}

We echo the others' findings that few studies investigated types of PCP contacts to inform changes that TC might bring about there is great diversity in the selection, gathering and reporting of PCP contact data.^{3,14,35} Campbell et al is the best study so far to have examined 20 types of primary care contacts.²⁵

Given the variety of labelling and classification of PCP contacts, we had difficulty in pooling data on specific contacts. Two studies showed that reduced contacts with PCPs were associated with increased contacts with, suggesting the transfer of workload from doctors to

nurses given no significant change to total contacts with PCPs.^{25,31} The formation of such a workload pattern would be heavily influenced by nursing capacity in absorbing or buffering the added responsibilities, which partly explained the high attribution among practices randomized to the arm of TC intervention.²⁵

Like Iseli et al,³⁹ we found great variation in the measurement of patient satisfaction, leading to the uncertainty about this evidence. We agree that there is a lack of quality evidence about patient satisfaction with TC.⁴⁰ More studies regarding patient satisfaction linked with performance of TC shall be conducted to enhance the knowledge about health service practice.

6.4 Limitation

Our study has some limitations. Time and technologies are key factors that influence service delivery. TC varies to a great deal, depending on existing and available technologies, healthcare contexts, and patients' health-seeking behaviors. We used current criteria to assess evidence generated decades ago, which may amplify the methodological weaknesses (e.g., performance bias) in those studies. Since we did not search all health-related databases nor grey literature, we may have missed some studies that should be included in this review. Our findings thereby shall be interpreted with caution.

7 | CONCLUSION

It is certain, with high or moderate certainty of evidence, that TC increases the likeliness to have patients' problems solved by telephone advice alone without approaching doctors F2F — thus reduces their workload on the day of the first contact — compared with either normal standard or telephone-based management. Included studies consistently revealed that TC did not cause any negative effect on AEs in whichever comparison, but the evidence about this outcome and the others is uncertain (very low certainty of evidence). This is mainly caused by multiple-domain bias and inconsistency in outcome measurements across studies.

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WTC: Conceptualization; methodology; writing – original draft, review and editing;

supervision; resources; validation; visualization. SK: Conceptualization; methodology;

writing – original draft, review and editing; supervision; validation. YLZ: Conceptualization; methodology; writing – original draft, review and editing; investigation; data curation; formal

analysis; visualization. TL: Writing – original draft, review and editing; investigation; data

curation; formal analysis; validation; visualization. KCC: Methodology; writing – original draft, review and editing; formal analysis; validation; visualization.

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Table 1. Characteristics of included studies

Study ID & Setting	Study objectives	Study design	Participants	Intervention (I, TC group)	Comparator (C, control group)	Primary outcomes
Comparison I. TC vs Standard management						
Campbell et al., ²⁵ 2014, England, UK	To assess the effectiveness and cost consequences of TC for same-day consultation in primary care.	Cluster RT	Callers for same- day appointment request. I) n = 10,639 (GP triage: 5171; nurse triage: 5468); C) n = 5572. 53.7% below 60% of IMD (more deprived).	Telephone triage led by PCP or nurse using computerised algorithms soon after the index request.	Usual care (first contact within 7 days of index request)	Primary care contact (total number of 20 types of contacts) within 28 days of index request
Darnell et al., ²⁶ 1985, Indiana, USA	To examine the effect of after- hours TC on hospitalisation and ER visits in city outpatient clinic.	Cluster RT	Registered patients at the outpatient clinic for scheduled visit during six-month introduction period. C) n = 1849; C) n = 778 Typically, poor patients.	After-hours telephone access to physicians with or without access to computerised medical reports	Usual care (no after- hours coverage in the general medicine clinic)	Hospitalisation and ER visit in the preceding year.
McKinstry et al., ²⁷ 2002, Scotland, UK	To investigate the impact of telephone consultation for same-day appointment request on service use and patient perceptions.	RT	Patients seeking same-day appointments at each surgery of two urban practices over a 4- week period. C) n = 194; C) n = 194 Mainly working class patients.	Telephone appointment with a PCP on the index- day.	Face-to-face appointment with a PCP.	Resource use (doctor contact time and subsequent contacts)
Stirewalt et al., ²⁸ 1982, Florida, USA	To determine the effect of a specialised telephone service on unscheduled visits to ambulatory care and patient satisfaction with care in a veteran medical center.	RT	Patient with drop- in visit without appointment over a 2-year intake period. C) n = 279; C) n = 282 Social class: (5=lowest): I) 3.75; C) 3.84.	Specialised telephone service by a thoroughly trained clerk according to the protocol.	Usual care (no information about the telephone service)	Patient satisfaction; Number of drop- in visits.
Vorster & Stott, ³¹ 2004, England, UK	To examine the effect of nurse telephone triage with computerised decision support for same-day appointment request on reducing costs and PCP & nurse time.	RT	All consecutive patients phoned (9am to 11am, Monday and Friday) the surgery of an urban/semi-rural general practice for same-day appointment request during the study period. I) n = 189; C) n = 182	Telephone consultation by trained practice nurse using decision- support software.	Usual care (care provision according to patient request mainly for emergency appointment with a PCP)	Number, length and costs of appointments.

Study ID & Setting	Study objectives	Study design	Participants	Intervention (I, TC group)	Comparator (C, control group)	Primary outcomes
Comparison II. Nurse-TC versus Doctor-TC						
Lattimer et al., ² 1998, England, UK	To determine the safety and effectiveness on adverse events and call management of nurse telephone consultation in out-of-hours primary care.	RT	All patients contacting the out- of-hours service (i.e., calls during specified evening and weekend hours) across a trial year. 10,134 patients made 14,492 calls: I) n = 7184; C) n = 7308. Predominately rural but including city of Salisbury.	Telephone consultation service by trained nurses (using decision-support software) integrated with a general practice cooperative.	Usual care (out-of- hours service by deputising cooperative PCPs)	Deaths within 7 days; Emergency hospitalisation within 24 hours and 3 days; A&E visit within 3 days.
Thompson et al., ²⁹ 1999, England, UK	To assess whether nurse telephone consultation was equally effective in managing workload at night.	RT	All patients contacting the night hours service (i.e., overnight calls from 11:15 pm to 8 am) across four weeks. 210 callers made 223 calls. I) n = 100; C) n = 123 Predominately rural but including city of Salisbury.	Same as Lattimer et al. ²	See the left.	Daytime surgery attendance within 3 days. Other outcomes same as Lattimer et al. ²
Comparison 3. Nurse-TC with versus that without the access to an algorithm						
Richards et al., ³⁰ 2004, England, UK	To assess the effects of NHS Direct triage on PCP and nurse workload and costs for same- day appointment request in general practice.	Cluster RT	Patients calling for same-day appointment during a 26-week study period. C) n = 2251; C) n = 2452 Patient population with higher unemployment and mortality.	Telephone consultation by NHS Direct nurse advisers using computerized algorithms.	Telephone consultation by trained practice nurses according to usual clinical protocols.	Consultation types after the index request (final point of contact); 1- month consultation time and service use; Costs.

Note: C: Control; ER: Emergency room; I: Intervention by telephone consultation (TC); IMD: Index of Multiple Deprivation; Nurse-TC: TC provided by nurses; doctor-TC: TC provided by doctors; PCP: Primary care physician; RT: Randomized trial; TC: Standard management: Normal face-to-face care for the first management of contact.

Table 2. Summary of TC interventions

Study	Brief name	Recipient	Why	What (materials)	What (procedures)	Who provided
Campbell et al., ²⁵ 2014	Clinician phone consultation	Patients (not 12-15 years)	Same-day appointment request	Computer decision support software (CDSS) for nurse triage	Researchers randomised patients. Reception staff informed patients of the call from a GP or nurse within 1-2 hours.	Trained GPs and nurse
Darnell et al., ²⁶ 1985	Physician after- hours service	Adult patients with ≥ 3 clinic visits in the previous year and a scheduled visit during the introduction period.	After-hours care	Patients received the clinical card with after- hours telephone number and instructions on how to use it. Portable terminal (remote access to patient record) and telephone line were installed at home for telephone services.	Patients with the card called for service. Duty physicians took turns for one- week telephone consultation with or without the access to patient records.	10 general internal medicine faculty members
Lattimer et al., ² 1998	Nurse phone consultation (evening and weekend)	Patients in the study practices during 26 2- week periods.	Evening and weekend care	Telephone advice system (i.e., computer based primary call management system)	Receptionist took the calls and then diverted to duty nurse(s) for the service (otherwise passed calls on to a doctor for those in the control)	Six nurses for six weeks
Thompson et al., ²⁹ 1999	Nurse phone consultation (overnight)	Patients in the study practices during two 2- week periods.	Overnight care (11:15 pm -8 am)			
McKinstry et al., ²⁷ 2002	GP phone consultation	Patients or carers of children who telephoned the practices	Same-day appointment request (non-very urgent)	None	Patients consented to a later contact. Doctors called back later that morning to give advice or treatment or see the patient later in the day when necessary.	GPs
Richards et al., ³⁰ 2004	NHS Direct consultation	Patients or carers called the practices.	Called for same-day appointments.	CDSS	Reception staff sought for consent followed by further confirmation by nurse adviser.	NHS Direct
Stirewalt et al., ²⁸ 1982	Telephone clerk consultation	Patients with a history of drop- in for care without appointments over	Health related concerns (e.g., pharmacy, social work, nursing, dietetics)	Protocols for telephone triage and referral network.	A research assistant randomly selected patients on a 4-week cycle (varied 2-hour timeslot/day/week). Eligible patients received a card with	Trained clinical clinician

Study	Brief name	Recipient	Why	What (materials)	What (procedures)	Who provided
		a 2-year period of intake.			the telephone number and met the telephone operator. They were encouraged to call rather than drop in for care afterwards.	
Vorster & Stott, ³¹ 2004	Practice nurse phone consultation	Patients phoned from 9am to 11am each Monday and Friday during the study period.	Same-day appointment	Telephone advice system decision support software (i.e., CDSS).	Receptionists recorded the request and obtained verbal consent. Patients waited on the phone for practice nurses to call back.	Practice nurse

Note: CDSS: Computer decision support software; GP: general practitioner; NHS: National Health Service.

Table 3. Summary of findings about the effect of telephone consultation compared with the control

Patient or population: Patients or cares who call a service for prompt healthcare within- or out-of-hours (OOH)
 Setting: Primary care setting
 Comparison I. Intervention: Telephone consultation (TC); Comparison: Standard (face-to-face) management
 Comparison II: Intervention: TC provided by nurses (nurse-TC); Comparison: TC provided by doctors (doctor-TC)
 Comparison III: Intervention: Nurse-TC with the access to an algorithm; Comparison: Nurse-TC without the access to an algorithm

Outcomes	Anticipated absolute effects ^a (95% CI)		Relative effect (95% CI)	№ of participants (studies)		Certainty of the evidence (GRADE)	Comments
	Risk with [comparison]	Risk with [intervention]		ICC adjusted	Sample size		
Comparison I. TC vs. Standard management							
Call resolution	11 per 1,000	157 per 1,000 (86 to 285)	RR 14.33 (7.87 to 26.07)	2,766 (2 RTs)	16,582	⊕⊕⊕○ Moderate ^b	Compared with standard management, TC may slightly increase the proportion of patients to have healthcare concerns resolved by telephone advice alone. ^{25, 31}
Index-day PCP contact F2F	924 per 1,000	370 per 1,000 (213 to 628)	RR 0.40 (0.23 to 0.68)	3,154 (3 RTs)	16,970	⊕⊕⊕○ Moderate ^b	Compared with standard management, TC probably reduces the proportion of patients to go to see doctor at primary care setting for the first consultation to have healthcare concerns resolved. ^{25, 27, 31}
Length of consultation	The mean time vs standard was 0	MD 3.32 lower (5.56 lower to 1.08 lower)	-	2,780 (2 RTs)	16,599	⊕⊕⊕○ Moderate ^b	Compared with standard management, TC probably reduces the length of (first) consultation. ^{25, 27}
Other outcomes ^c	-	-	-	-	-	○○○○○ Very low ^{b,d}	Evidence is very uncertain due to high or multiple 'some concerns' risk of bias and variety of outcome measures across studies (more see effect direction plots).
Comparison II. Nurse-TC vs. Doctor-TC							
Call resolution	500 per 1,000	654 per 1,000 (630 to 684)	RR 1.31 (1.26 to 1.37)	7,575 (2 RTs)		⊕⊕⊕○ Moderate ^e	
Index-day PCP contact F2F	500 per 1,000	345 per 1,000 (325 to 365)	RR 0.69 (0.65 to 0.73)	7,575 (2 RTs)		⊕⊕⊕○ Moderate ^e	Compared with doctor-TC, nurse-TC may slightly increase the proportion of patients to go to see doctor at primary care setting for the first consultation to have healthcare concerns resolved. ^{2, 29}
Other outcomes ^c	-	-	-	-	-	○○○○○ Very low ^{b,d}	Evidence is very uncertain due to high or multiple 'some concerns' risk of bias and variety of outcome measures across studies (more see the effect direction plots).
Comparison III. Nurse-TC with vs. that without the access to an algorithm							
All specified outcomes	-	-	-	-	-	Not applicable	Only one study at high risk of bias was included. ³⁰

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

CI: confidence interval; MD: mean difference; RR: risk ratio; F2F: face-to-face; ICC: intraclass correlation coefficient (here 0.015); PCP: primary care physician.

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: 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 certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations: ^aThe 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). ^b“Some concerns” risk of bias. ^cOther outcomes include subsequent PCP contact, AEs, patient satisfaction. For Comparison II, “other outcomes” also include length of consultation. ^dDifferent outcome measures. ^eDifferent intervention timeslots.

Figure 1. Flow diagram of the screening process

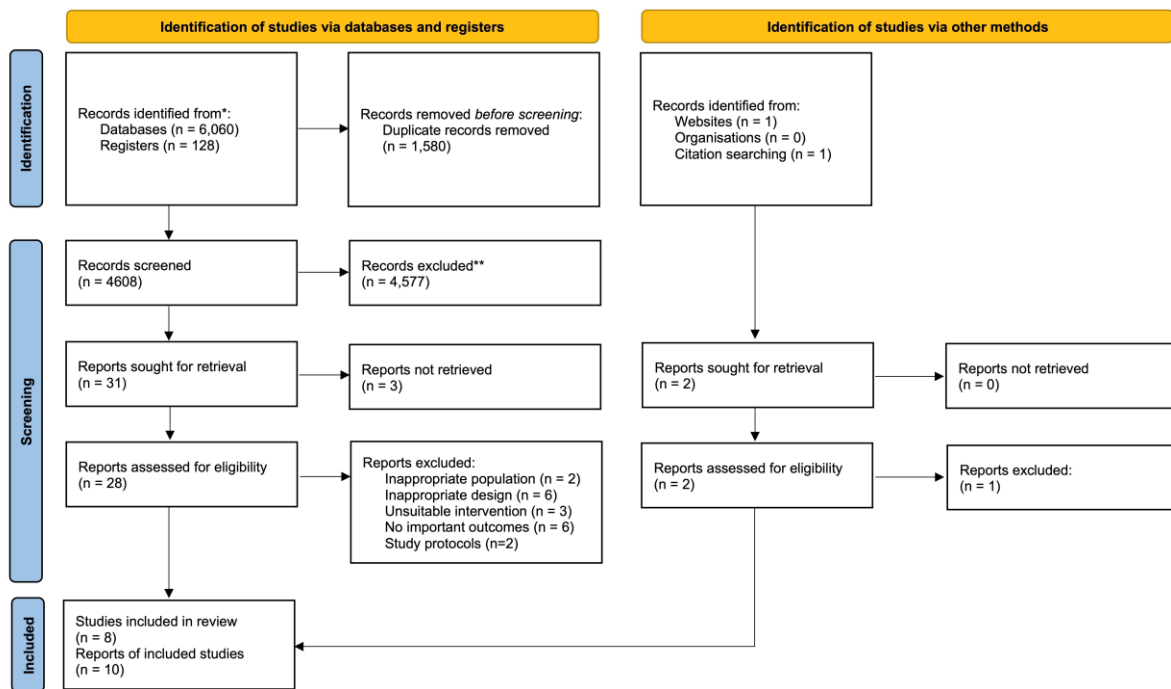


Figure 2. Risk of bias by comparison and outcomes

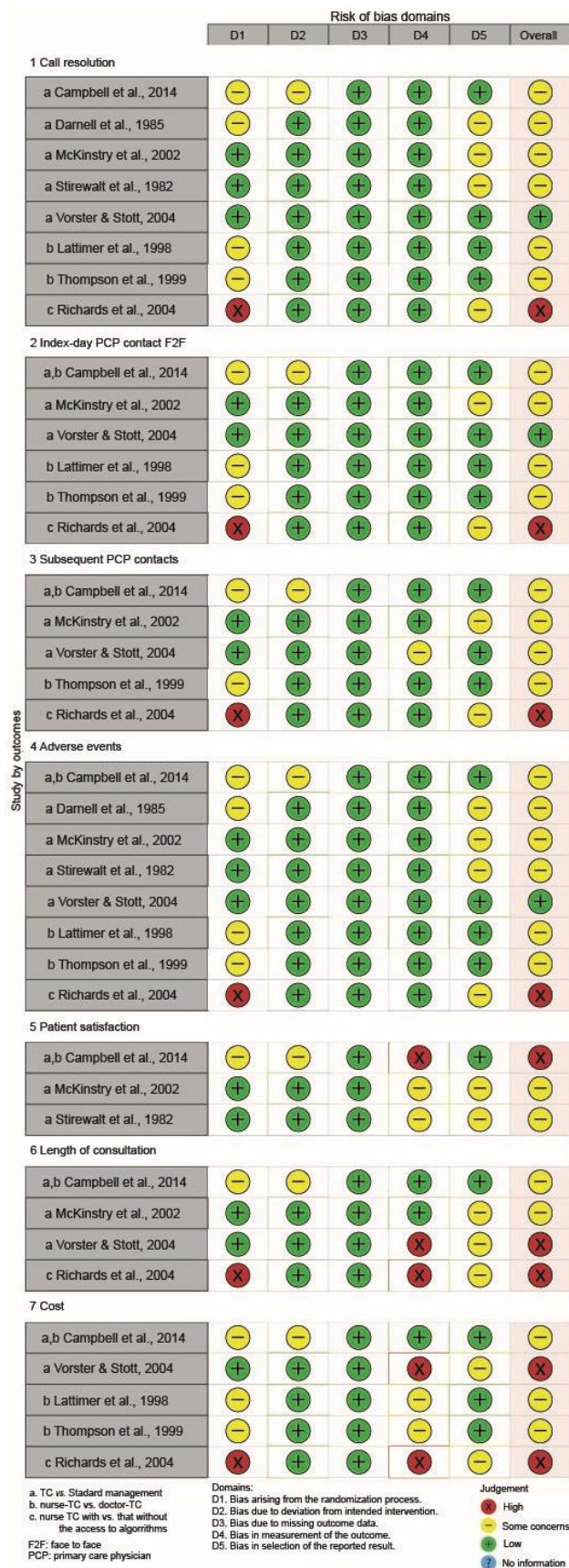


Figure 3. Forest plots by comparison and outcome

A1. Comparison I. TC vs. Standard management on call resolution

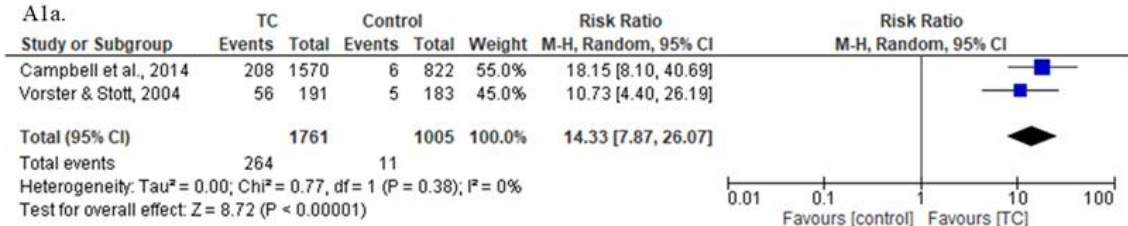
A1a. TC vs. Standard management

A1b. Nurse-TC vs. Standard management

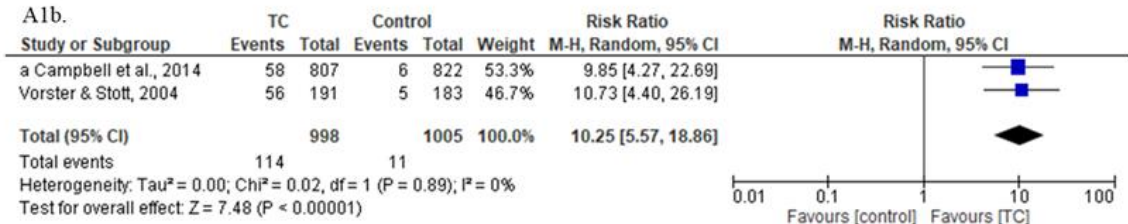
A2. Comparison I. TC vs. Standard management on index-day PCP contact F2F

A1

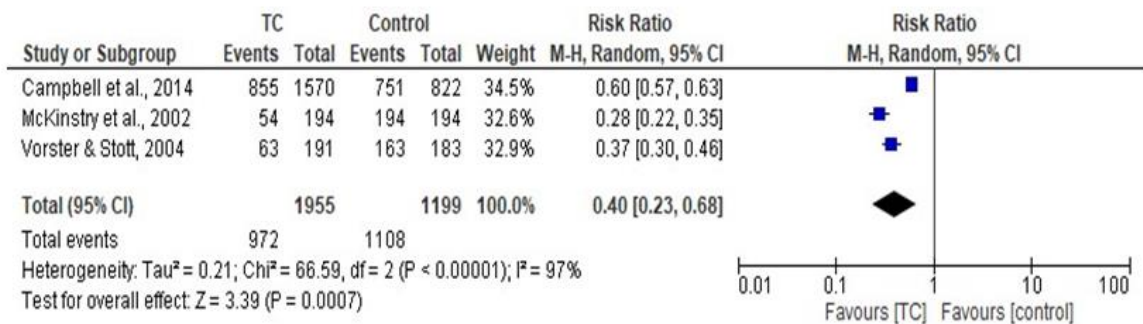
A1a.



A1b.

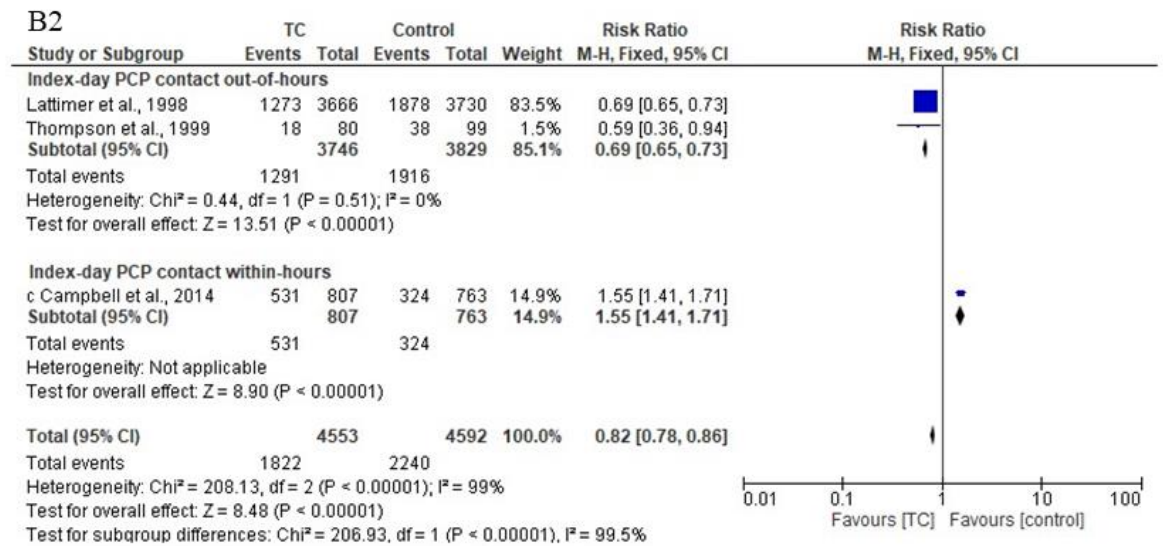
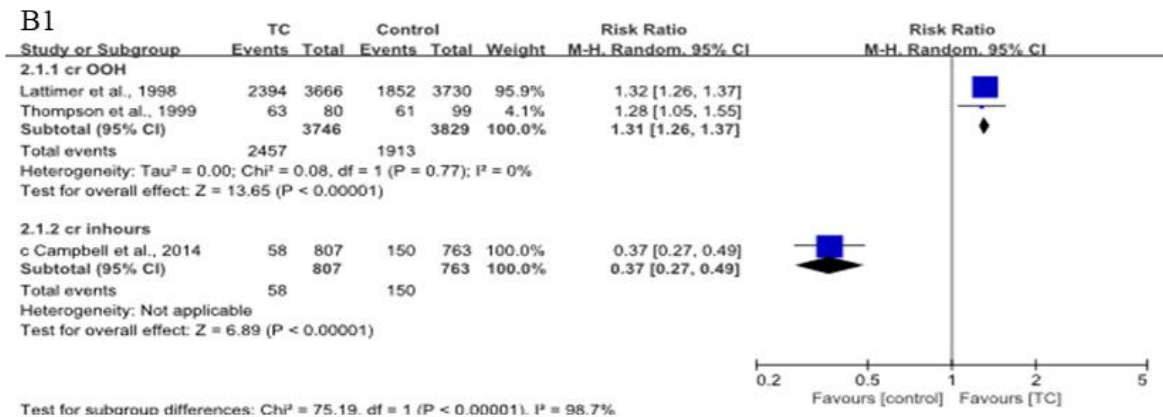


A2



B1. Comparison II. Nurse-TC vs. doctor-TC on call resolution

B2. Comparison II. Nurse-TC vs. doctor-TC on index-day PCP contact F2F



C. Comparison I. TC vs. Standard management on length of consultation

