Supplemental Table 1: Risk of Bias Assessment

Reference	1. Was there a clear statement of the aims of the research?	2. Is a qualitative methodology appropriate?	3. Was the research design appropriate to address the aims of the research?	4. Was the recruitment strategy appropriate to the aims of the research?	5. Was the data collected in a way that addressed the research issue?	6. Has the relationship between researcher and participants been adequately considered?	7. Have ethical issues been taken into consideration?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?
Forrest et al 2002	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Kinchen et al 2004	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Abel et al 2012	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Barnett et al 2012	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Brown et al 2013	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Gao et al 2021	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Makovkina et al 2021	Yes	Yes	Yes	Moderate	Yes	No	Yes	Yes	Yes

Supplemental Table 2: Factors considered when making referrals and resultant codes abstracted from full text review

	Consultant's clinical expertise		Interactions between patient and consultant		Interactions between referring physician and consultant	
	Factor	**Code**	**Factor**	**Code**	**Factor**	**Code**
Forrest et al. 2002	Technical capacity	Clinical Skill	Quality of prior feedback	Prior Patient Experience	Personal knowledge of the specialist	Personal knowledge/relationships
			Appointment availability	Convenience of Scheduling		
			Patient request	Patient Preference		
			Requirement of patient's health plan	Insurance		
			Proximity of specialist to patient's home	Location		
Kinchen et al. 2004	Medical skill Board certification	Clinical Skill	Previous experience with specialist	Prior Patient Experience	Specialist returns to primary physician	Patient returns
			Patient convenience Office location	Location	PCP relationship with specialist	Personal knowledge/relationships
	Quality of communication	Communication	Appointment timeliness	Convenience of Scheduling	Hospital affiliation	Hospital/Practice Affiliation
			Likelihood of good patient-physician rapport	Rapport	Attitudes of colleagues towards specialist	Reputation
	Medical school Fellowship training institution	Training	Insurance coverage	Insurance	Specialist refers patients to primary physician	Reciprocity
			Patient preference for particular specialist	Patient Preference		
Abel et al. 2012	Reputation of specialist/facility	Reputation	Patient's preference for site of care	Patient Preference	Practice's affiliation with specialist	Hospital/Practice Affiliation
	Specialist's affiliation with cancer center	Hospital/Practice Affiliation	Distance of site from patient's home	Location	Personal relationship with specialist	Personal knowledge/relationships
	Availability of clinical trials at referral site	Other	Patient's ability to pay	Insurance	Possibility of losing patient to specialist	Patient returns
Barnett et al. 2012			My patients have good experiences with this physician	Prior patient experience	Quality of communication with me Shares my medical record system	Communication
			Physician has good patient rapport	Rapport		
			Timely availability of appointments	Convenience of Scheduling	Physician refers to me	Reciprocity
			Location convenient for patient	Location		
			Patient request	Patient Preference	Works in my hospital or practice	Hospital/Practice Affiliation
			Speaks patient's language	Communication		
Brown et al. 2013	Report cards	Summative assessment	Patient satisfaction	Prior patient experience	Hospital affiliation	Hospital/Practice Affiliation

	Technical skill Clinical judgement Post-operative care	Clinical Skill				
	Outcomes other than mortality Risk-adjusted mortality	Clinical Outcome				
	Effective communication	Communication				
Gao et al. 2021	Patient complexity Surgeon experience and volume	Clinical Skill	Preference for care to be received locally	Location	GIs preferred to refer to colorectal surgeons while most general surgeons perform surgery on patients they diagnose	Other
			Specialist availability	Convenience of Scheduling		
	GIs would refer a family member to a trusted colorectal surgeon. Surgeons would refer a family member to a large or academic center.	Other	Patient Preference	Patient Preference	Preference to remain in health system	Hospital/Practice Affiliation
Makovkina and Kern 2021	Clinical judgement	Clinical Skill	Geographic preference	Location	Preference or Institutional pressure to refer within organization Cost containment	Hospital/Practice Affiliation
			Ease of scheduling Flexibility in accommodating urgent referrals	Convenience of Scheduling		
			Patient feedback	Prior patient experience		
	Clinical reputation of physicians organization	Reputation	Insurance coverage	Insurance	Personal knowledge and trust of specialist	Personal knowledge/Relationships
			Patient preference	Patient Preference	Ease of communication and coordination of care Shared EMR	Communication

Supplemental Table 3: Methods for weighing factor importance and importance weight of included survey studies

Included Study	Method for weighting factor	Reported Weight	Weight given to factor	Factors Cited in Selecting Specialist
Forrest et al. 2002	Importance rating of factor in each referral examined (scale 1-3)	Mean importance rating	2.6	Personal knowledge of the specialist
			2.5	Quality of prior feedback
			2.3	Technical capacity
			2	Appointment availability
			1.6	Patient request
			1.6	Requirement of patient's health plan
			1.6	Proximity of specialist to patient's home
Kinchen et al. 2004	4 point Likert scale (no, mild, moderate, and major importance)	Percent of providers who rated factor as having major importance	87.5	Medical skill
			59.2	Previous experience with specialist
			55.4	Appointment timeliness
			52.5	Quality of communication
			51.4	Likelihood of good patient-physician rapport
			51.1	Specialist returns [patient] to primary physician
			49.6	Insurance coverage
			40.9	Patient preference for particular specialist
			35.9	Primary care physician relationship with specialist
			33.9	Board certification
			23.8	Patient convenience
			14.5	Attitudes of colleagues towards specialist
			13.6	Hospital affiliation
			9.4	Office location
			4.2	Specialist refers patients to primary physician
			0.4	Medical school
			0.2	Fellowship training institution
Abel et al 2012	5 point Likert scale (ranging from 1="not important" to 5="extremely important")	Percent of providers who rated factor as ≥3 (moderately, very, or extremely important)	96.2	Reputation of specialist/facility
			94	Patient's preference for site of care
			91.7	Distance of site from patient's home
			88.7	Specialist's affiliation with cancer center
			81.2	Practice's affiliation with specialist
			79	Personal relationship with specialist

			68.4	Patient's ability to pay
			66.9	Availability of clinical trials at referral site
			15.8	Possibility of losing patient to specialist
Barnett et al. 2012	Respondents provided up to two factors *besides clincal expertise* for each referral relationship	Percent of relationships in which factor was considered important	53.1	My patients have good experiences with this physician
			30.5	Works in my hospital or practice
			25.1	Physician has good patient rapport
			19.5	Quality of communication with me
			13	Location convenient for patient
			12.5	Shares my medical record system
			12.2	Timely availability of appointments
			3.5	Patient request
			2.5	Physician refers to me
			0.5	Speaks patient's language
Brown et al 2013	5 point Likert scale (not, minimally, somewhat, very, or extremely important)	Percent of providers who rated factor as very or extremely important	99	Technical skill
			94.8	Post-operative care
			92	Outcomes other than mortality
			84.5	Clinical judgement
			83.1	Risk-adjusted mortality
			81.8	Patient satisfaction
			73.7	Effective communication
			58	Hospital affiliation
			18	Report cards

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Reported on Page #
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	-
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	6-7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	6-7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	-
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	-
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	-
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	-
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	-
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	-
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	-

Section and Topic	Item #	Checklist item	Reported on Page #
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	7, Fig 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	7-8
Study characteristics	17	Cite each included study and present its characteristics.	8, Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supp. Table 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	-
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	-
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	-
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	-
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	-
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	-
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	-
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	9-11
	23b	Discuss any limitations of the evidence included in the review.	12-13
	23c	Discuss any limitations of the review processes used.	12-13
	23d	Discuss implications of the results for practice, policy, and future research.	12
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Protocol provided on request
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	-
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Available on request

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: http://www.prisma-statement.org/

MOOSE Checklist for Meta-analyses of Observational Studies

Item No	Recommendation	Reported on Page No
Reporting of background should include		
1	Problem definition	5
2	Hypothesis statement	-
3	Description of study outcome(s)	6-7
4	Type of exposure or intervention used	-
5	Type of study designs used	6
6	Study population	6
Reporting of search strategy should include		
7	Qualifications of searchers (eg, librarians and investigators)	5-6
8	Search strategy, including time period included in the synthesis and key words	6
9	Effort to include all available studies, including contact with authors	6-7
10	Databases and registries searched	5
11	Search software used, name and version, including special features used (eg, explosion)	5
12	Use of hand searching (eg, reference lists of obtained articles)	5
13	List of citations located and those excluded, including justification	7-8
14	Method of addressing articles published in languages other than English	6
15	Method of handling abstracts and unpublished studies	6
16	Description of any contact with authors	7
Reporting of methods should include		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	6
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	7
19	Documentation of how data were classified and coded (eg, multiple raters, blinding and interrater reliability)	7
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)	-
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	7
22	Assessment of heterogeneity	-
23	Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	-
24	Provision of appropriate tables and graphics	Tables 1-3

Reporting of results should include		
25	Graphic summarizing individual study estimates and overall estimate	-
26	Table giving descriptive information for each study included	Table 1
27	Results of sensitivity testing (eg, subgroup analysis)	-
28	Indication of statistical uncertainty of findings	-
Reporting of discussion should include		
29	Quantitative assessment of bias (eg, publication bias)	-
30	Justification for exclusion (eg, exclusion of non-English language citations)	6
31	Assessment of quality of included studies	Supp. Table 1
Reporting of conclusions should include		
32	Consideration of alternative explanations for observed results	10-13
33	Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	13
34	Guidelines for future research	12
35	Disclosure of funding source	13

From: Stroup DF, Berlin JA, Morton SC, et al, for the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. Meta-analysis of Observational Studies in Epidemiology. A Proposal for Reporting. *JAMA*. 2000;283(15):2008-2012. doi: 10.1001/jama.283.15.200