Study Guide 17: How to Write an Abstract

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(1) Overview and learning outcomes

Whether you are preparing a poster or oral presentation for a conference or writing a paper for submission to a journal it is very important to prepare a good abstract. The abstract is there to attract the reader, is often the only part that is read, or published, and is critical in encouraging a conference organiser or editor to accept your poster, presentation or paper in the first place. Preparing the abstract requires skill and attention to detail. After reading this guide you should be able to:

- Identify which reports need an abstract
- State the components of a good abstract
- Recognise the difference between a good and poor abstract
- Describe the different styles of abstracts (structured versus unstructured)
- Have gained practical experience of preparing a good abstract

Associated NHS Fife study guides:
18 How to write up and get your work published

(2) Types of reports that need an abstract

Abstracts are required for the following reports:

1. Conference presentations (whether oral or poster)
2. Original scientific studies, whether for a full paper (2000-4000 words) or for a short report (800 – 1000 words)
3. Internal reports
4. Case reports or case series
5. Student texts / assignments

Abstracts are seldom required, if ever, when writing a review article (book or subject), an invited editorial or a letter to a journal editor.

An abstract submitted for presentation at a conference will be scored by independent reviewers for its content, clarity, originality, scientific merit, and clinical relevance. Competition may be high so it is important that the abstract attains a high score. Poorly written abstracts will not achieve this and the work will be declined by the conference organisers. Furthermore, it is important that the work has been

completed. Inclusion of a statement such as 'collection of further data is ongoing and full results will be presented' is an invitation to dismiss the abstract out of hand.

A paper submitted for publication in a journal will first have its abstract reviewed by the editor who will decide whether it should be sent for full peer review. If acceptable, the editor will then send the abstract to one or more reviewers (referees) with an invitation to review the full paper. Referees are not usually paid and editors will wish to protect their cohort of willing referees by not asking them to waste their time reviewing poorly reported studies. Hence, again, the abstract must be informative and well written to overcome these initial hurdles.

Internal reports should have an abstract, sometimes referred to as an 'Executive Summary'. The usual limitations on word count will not apply to such statements but the abstract or executive summary should not be overly long. An internal report may also require a lay summary for the general readership.

(3) First thoughts

First read the conference guidance or journal instructions to authors regarding the style (structured or unstructured) and word count for an abstract.

Second, decide what the key messages are. Try writing two or three sentences on: 'What do we know already about this subject?' and 'What does this study add?' This exercise will help focus the content.

Third, devise an informative but attractive title. This is critical in attracting the casual reader. The title may be a description of what was studied (*Maternal obesity and the risk of stillbirth: a population based case control study*) or a statement of the findings (*Maternal obesity is an independent risk factor for stillbirth in nulliparous, Caucasian women*).

Write the first draft in good English with a style that makes it readable but, at this stage do not limit the word count as the text can be précised later to fit with the requirements. Write with an international audience in mind as your work may be read by individuals who are not native English speakers. If space allows write as if your audience is ignorant of the subject to improve the clarity of the content. Tips for writing an abstract include:

1. Use short, concise sentences where possible.
2. Use active not passive tense. *For example, 'cats eat fish' (active tense) rather than 'fish are eaten by cats' (passive tense).*
3. Use positive rather than negative statements. *For example, '90% of students passed' rather than 10% of students failed'.*
4. Use simple words. *For example, 'the study shows...' rather than 'the study demonstrates...'*
5. Use abbreviations and acronyms where possible (to reduce word count) but spell them in full on their first appearance.
6. Cite numbers in numerical form rather than as words (to reduce word count).
7. Avoid needless words.
8. Avoid imprecision and irrelevance.
9. Avoid double negatives. *For example, 'diabetes is common' rather than 'diabetes is not uncommon'.*

(4) Example of a poor abstract

Here is an example by Sir James Howie in 'How to do it', a collection of articles published in the British Medical Journal, BMJ Publications, 1979 (see the chapter 'How to attract the reader', page 140).

'An extensive survey of chickens in various situations has been made to ascertain the incidence and points of origin of salmonellas. The study identified where infection had been acquired. The implications of our findings are discussed and point to the need for further research.' [44 words]

The content of this abstract does not encourage the reader to investigate further; it is imprecise on settings and methods and leaves the reader uninformed regarding the 'implications' of the study. A better effort would be:

Five thousand chickens were examined for salmonellas in 20 farms, three processing plants and 100 shops. Infected feed containing fish meal on one farm was found to result in widespread contamination of birds from that farm and, through them of birds as they passed through one processing plant. We conclude that efforts to produce clean poultry feed and to improve the hygiene of farms and processing plants will do more to control food poisoning than the numerous, currently popular but futile searches for human so-called carriers in shops, restaurants and homes. [91 words]

(5) The content and structure of an abstract

The abstract should 'stand alone' as a comprehensive description of the study, its findings and conclusions. Abstracts may be published in conference proceedings and those from papers will be published in databases such as MEDLINE and PubMed. The abstract should answer five key questions:

1	Why did you start?	*Introduction / Background*
2	What did you try to do?	*Aims / Objectives*
3	What did you do?	*Methods / study design / setting / participants / main outcome measures*
4	What did you find?	*Results*
5	What does it mean?	*Conclusions / Recommendations / the 'so what'*

The introduction, background, conclusions and any recommendations should consist of one or two sentences only. The results section should comprise about half the word count and should not include any tables or figures. The first draft need not be constrained by the word count. Later the text will need to be trimmed but without sacrificing the important content. Many drafts may be necessary but do not discard earlier ones. If your paper is rejected by one journal a resubmission to an alternative journal may require a different structure, or word count.

Proof reading is important. Ask a colleague to check it for content, accuracy and comprehension. Spelling mistakes are easily missed. Try reading this text:

I cdnuolt blveiee that I cluod aulaclty uesdnatnrd what I was rdanieg. The phaonmneal pweor of the hmuan mnid, aoccdrnig to a rscheearch sutdy at Cmabrigde Uinervtisy, it dseno't mtaetr in what oerdr the ltteres in a word are, the olny iproamtnt tihng is that the frsit and last ltteer be in the rghit pclae. The rset can be a taotl mses and you can still raed it whotuit a pboerlm. This is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the word as a wlohe. Azanmig. I awlyas tghuhot slpeling was ipmorantt!

Apparently, only 55% of us can read this easily. How did you get on?

Abstracts can be structured or unstructured. In a structured abstract the text is broken up into sections each with a separate heading. The headings will be specified in the instructions to authors. Here is an example from one journal:

1. Background
2. Objective(s)
3. Study design
4. Setting
5. Participants
6. Main outcome measures
7. Principal findings
8. Conclusions / Recommendations

An unstructured abstract may follow the same approach but not retain the headings. In practice, it helps to adopt the structured approach even if the instructions do not request it. To illustrate this see the examples below which give two versions of a structured abstract and one version of an unstructured abstract from a study investigating the reasons why patients chose not to take part in a physical activity promotion trial being conducted in primary care.

TITLE: FACTORS ASSOCIATED WITH NON-PARTICIPATION IN A PHYSICAL ACTIVITY PROMOTION TRIAL

Example 1 (structured abstract) (271 words)

Background. Non-participation can bias outcome in intervention studies of physical activity.

Objectives. To compare characteristics, knowledge and attitudes to physical activity in participants and non-participants of a physical activity intervention trial in primary care.

Study design. Cross-sectional survey.

Setting. An inner city general practice, Newcastle-upon-Tyne.

Participants. Patients aged 40-64 years recruited opportunistically during surgery visits.

Methods*.* Attitudes to physical activity, views of its health benefits and barriers to participation were elicited in interviews with participants, and by postal questionnaire from non-participants. GP held data were used to compare anthropometry and lifestyle between groups.

Results*.* Of 842 eligible patients, 276 (33%) refused outright (non-volunteers) and 566 volunteered for the intervention study, of which 353 (42%) attended a baseline assessment and 213 (25%) subsequently defaulted. The initial refusal rate was relatively higher amongst men, smokers and those with addresses in more deprived areas. Response rate to the postal survey of non-volunteers was 45%. Compared with participants the non-volunteers were more likely to be an adult carer and to report poorer health, and less likely to have had higher education or have children living at home. Far more non-volunteers considered they already did enough exercise to maintain health. Non-volunteers had less knowledge of the benefits of physical activity, attached far less importance to it in maintaining health and were more likely to cite 'internal', non-modifiable barriers.

Conclusion*.* Recruitment of 'hard to engage' individuals requires careful phrasing of the message to focus on their personal goals and to address gaps in their knowledge about physical activity and the principal barriers they perceive. Differential uptake across population subgroups could lead to a widening of health inequalities.

Example 2 (structured abstract, for a different journal) (337 words)

Background**:** Non-participation can bias outcome in primary-care based intervention studies of physical activity (PA). Knowledge of the characteristics and attitudes to PA of those who decline to enrol in a program are needed to inform recruitment strategies to improve uptake.

Methods**:** Attitudes to PA, views of its health benefits and barriers to participation were elicited in interviews with participants, and by postal questionnaire from non-participants in the Newcastle Exercise Project (NEP). Patients aged 40-64 years were recruited opportunistically during visits to an inner city general practice, Newcastle-upon-Tyne, UK, 1993-95. GP held data were used to compare anthropometry and lifestyle between participants and non-participants.

Results**:** Of 842 eligible patients, 276 (33%) refused outright (non-volunteers) and 566 volunteered for the intervention study, of which 353 (42%) attended a baseline assessment and 213 (25%) subsequently defaulted. The initial refusal rate was relatively higher amongst men, smokers and those with addresses in more deprived areas. Response rate to the postal survey of non-volunteers was 45%; as a group, those who replied under-represented smokers and those living in more deprived areas. Compared with participants the non-volunteers were more likely to be an adult carer and less likely to be a home owner, or to have had higher education. Non-volunteers reported poorer health, had less knowledge of the benefits of PA and attached less importance to it in maintaining health compared with participants. 62% of non-volunteers considered they already did enough exercise to maintain health, compared to 28% of participants. Non-volunteers were more likely to cite 'internal' barriers and cited dislike of exercise, poor health and fear of leaving their home unattended more frequently compared with participants.

***Conclusions*:** Primary care patients most likely to benefit from a PA intervention are least likely to join it. Recruitment of these 'hard to engage' individuals will require careful phrasing of the message to focus on their personal goals and to address gaps in their knowledge about PA and the principal barriers they perceive. Differential uptake across population subgroups could lead to a widening of health inequalities.

Example 3 (unstructured abstract derived from example 2) (333 words)

Non-participation can bias outcome in primary-care based intervention studies of physical activity (PA). Knowledge of the characteristics and attitudes to PA of those who decline to enrol in a program are needed to inform recruitment strategies to improve uptake. Attitudes to PA, views of its health benefits and barriers to participation were elicited in interviews with participants, and by postal questionnaire from non-participants in the Newcastle Exercise Project (NEP). Patients aged 40-64 years were recruited opportunistically during visits to an inner city general practice, Newcastle-upon-Tyne, UK, 1993-95. GP held data were used to compare anthropometry and lifestyle between participants and non-participants. Of 842 eligible patients, 276 (33%) refused outright (non-volunteers) and 566 volunteered for the intervention study, of which 353 (42%) attended a baseline assessment and 213 (25%) subsequently defaulted. The initial refusal rate was relatively higher amongst men, smokers and those with addresses in more deprived areas. Response rate to the postal survey of non-volunteers was 45%; as a group, those who replied under-represented smokers and those living in more deprived areas. Compared with participants the non-volunteers were more likely to be an adult carer and less likely to be a home owner, or to have had higher education. Non-volunteers reported poorer health, had less knowledge of the benefits of PA and attached less importance to it in maintaining health compared with participants. 62% of non-volunteers considered they already did enough exercise to maintain health, compared to 28% of participants. Non-volunteers were more likely to cite 'internal' barriers and cited dislike of exercise, poor health and fear of leaving their home unattended more frequently compared with participants. Primary care patients most likely to benefit from a PA intervention are least likely to join it. Recruitment of these 'hard to engage' individuals will require careful phrasing of the message to focus on their personal goals and to address gaps in their knowledge about PA and the principal barriers they perceive. Differential uptake across population subgroups could lead to a widening of health inequalities.

(6) An exercise in writing an abstract

Read the paper below and compose a structured abstract of 250 words or less. Use the following headings:

- Background
- Objective(s)
- Study design
- Setting
- Participants
- Main outcome measures
- Principal findings
- Conclusions

Compare your abstract with the published version in:

Masson S, Chinn DJ, Tabaqchali MA, Waddup G, Dwarakanath AD. Is anaemia relevant in the referral and diagnosis of colorectal cancer? *Colorectal Disease* 2007; **9**: 736-739.

TITLE: IS ANAEMIA RELEVANT IN THE REFERRAL AND DIAGNOSIS OF COLORECTAL CANCER?

Keywords: Colorectal cancer, anaemia, haemoglobin Word Count – 1327

Introduction

Colorectal cancer (CRC) is one of the commonest cancer diagnoses in the UK with around 30 000 new cases per year, and remains one of the commonest causes of cancer death in the UK [1]. In an effort to improve outcome and shorten the delay between referral and diagnosis there has been a considerable increase in investment in cancer diagnostic services in the UK National Health Service and the establishment of national cancer waiting time targets that guarantee urgent assessment [2]. To implement these standards, an appropriate threshold for referral must be set with referrals being guided by the national guidelines for suspected cancer [3,4]. With respect to CRC, the guideline's criteria for referral include symptoms (alteration in bowel habit and rectal bleeding), associated physical findings (abdominal or rectal masses) and secondary effects (iron-deficiency anaemia [IDA] and colonic obstruction). They are designed to assist identification of those at high risk in whom urgent investigation is warranted. However, they are not evidence-based and each referral criterion has its own level of risk, though the threshold for each is not always explicit.

Investigation of IDA undoubtedly has a high yield for the diagnosis of gastrointestinal malignancy [5]. In particular, it has long been held that right-sided CRC are most closely correlated with the incidence of anaemia [6-9]. However, it remains unclear as to how close this association is, and it has been shown that a diagnosis of anaemia is insufficiently sensitive to aid decision making when investigating a right-sided CRC [10]. Additionally, the diagnostic criteria for anaemia in IDA vary widely between published studies, and the level of anaemia that requires investigation has not been clarified.

We aimed to explore the relationship between anaemia and CRC. In particular, we examined the occurrence of anaemia in patients with CRC to determine the frequency of anaemia in relation to the diagnosis and site of tumour.

Patients and methods

We reviewed the hospital laboratory database and collected data prospectively from diagnosis on patients diagnosed with CRC between January 2003 and June 2004. The site of the cancer was noted together with the haemoglobin (Hb) estimation of each patient at the time of referral. Anaemia was defined according to local practice as Hb <12g/dl in females and Hb <13 g/dl in males, representing the lower limits of our hospital reference laboratory. This differs from the threshold used in the current national guidelines (Hb <10g/dl in females and Hb <11g/dl in males).

Data were analysed using SPSS [11]. Comparison of proportions was made using the Chi-squared test and the 5% level indicated statistical significance.

Results

Over 18 months, 143 patients were diagnosed with CRC; 85 (59%) were male and 58 (41%) were female. Ages ranged from 30 to 92 years in men (mean 67.4, standard deviation 12.6) and 38-90 years in women (mean 71.1, standard deviation 11.9). The tumours were located on the right-side in 47 (33%) and on the left-side in 96 (67%), including 68 (48%) rectal tumours. Mean Hb was 12.0g/dl (standard deviation 1.9, range 8.7-14.8) in female patients (lab reference 12.0-16.0g/dl) and 12.7g/dl (standard deviation 2.2, range 7.0-16.8) in male patients (lab reference 13.0-18.0g/dl). Anaemia was present in 50% of female patients and 48% of male patients. These proportions were 15.5% in females and 23.5% in males using the national referral guidelines. Anaemia was present more frequently in those with right-sided compared with left-sided tumours, and in those with non-rectal compared with rectal tumours; the difference in proportions was statistically significant for females and, with one exception, for males (Table 1).

Overall, using the laboratory reference values for haemoglobin, the difference in proportion with anaemia for both sexes combined was, for right-sided versus left-sided disease 32% (95% confidence interval 15 to 49%), and for non-rectal versus rectal disease 32% (95% confidence interval 16 to 48%). Using the national guideline for referral, the difference in proportion with reduced haemoglobin (both sexes combined) was, for right-sided versus left-sided disease 30% (95% confidence interval 17 to 43%), and for non-rectal versus rectal disease 22% (95% confidence interval 9 to 35%). In multiple regression analysis, after first adjusting for sex, the mean difference in Hb associated with (a) right-sided compared with left-sided cancers was -1.7g/dl (standard error of the mean, SEM, 0.3g/dl) and (b) non-rectal compared with rectal cancers was -1.6g/dl (SEM 0.3 g/dl).

Discussion

We have shown that the diagnosis of CRC is not associated with anaemia in at least half of all cases using our local laboratory reference values for haemoglobin levels. Furthermore, four out of five patients subsequently diagnosed with CRC had a haemoglobin level at referral *above* the national, Department of Health guideline for investigation for CRC. On further analysis, we demonstrated that patients with right-sided and non-rectal cancers had a significantly lower haemoglobin level at presentation than those with left-sided or rectal cancers, respectively. However, even in these groups, a significant proportion was not judged anaemic, with around one in three patients having a 'normal' Hb level. While a relationship exists between proximal lesions and anaemia, our results confirm those of others [10] that the presence of anaemia in CRC is too insensitive to be useful when making decisions about colonic imaging. Furthermore, the threshold level of anaemia at which current national guidelines recommend referral (Hb <11g/dl [male] or Hb <10g/dl [female]) [3,4] is lower than our own definition of anaemia and, consequently, the majority of patients, including those with right-sided and non-rectal disease, do not have a Hb below this threshold level. Clearly, anaemia is only one of several important referral criteria, but given that many patients with distal lesions will be symptomatic [7,9], the earlier detection of proximal lesions might be aided by a less stringent threshold. Indeed, there is no reason to believe that mild anaemia is less indicative of serious pathology than severe anaemia and there appears to be no correlation between the severity of anaemia and the presence of malignancy in asymptomatic patients with

IDA [12]. We consider the current threshold to be unjustified, being, as it is, not evidence based.

Current efforts to improve outcome appear to be targeted at improving the referral pathway, particularly the 'two week standard' [2]. It has been argued that the introduction of this route only serves to highlight the current mismatch between demand and service provision and occurs at the expense of 'routine' work [13]. In addition, secondary-care audit suggests that, despite the introduction of this referral pathway, although such clinics have higher diagnostic yields, they have yet to impact on delay to treatment or disease stage and that the majority of cases still bypass this route [14]. Notably, around 25-35% of all CRC patients currently present as surgical emergencies with obstruction or perforation [14,15] where optimizing outcome depends on access to appropriate specialist surgical expertise in the acute setting. Additionally, in future, patients will be increasingly diagnosed through screening based on recent pilot studies using faecal occult blood screens [16]. However, for now, the most common pathway to diagnosis will continue to be presentation to primary care with non-urgent symptoms. It is therefore important that referral guidelines are appropriate, supported by evidence and, where possible, based on predictive values of symptoms and other risks in primary care. In this regard, it is incontrovertible that IDA is an indication for gastrointestinal investigation on its own right [12,17,18]. However, our data highlight some important points about anaemia that are pertinent to the referral of patients with suspected CRC. While our results concur that right-sided and non-rectal cancer patients are more likely to be anaemic at presentation, this observation must not detract from the fact that the majority of patients with CRC are not anaemic. Additionally, we remain unconvinced in investigating only those with a more severe anaemia (as determined by the current national guidelines) and would advocate investigating all patients with IDA regardless of the degree of anaemia. In conclusion, even in the absence of anaemia, all patients in which CRC is suspected should be referred for urgent assessment via the 'two week standard'.

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Table 1. Summary statistics for haemoglobin concentration in 143 patients with colorectal cancer, by gender and site of cancer.

	All cases	Right-sided	Left-sided	P	Non-rectal	Rectal	P
Females (n)	58	22	36		37	21	
Haemoglobin (g/dl):							
Mean	12.0	10.7	12.9		11.3	13.4	
Median	12.0	10.3	13.5		11.5	13.8	
Standard deviation	1.9	1.6	1.5		1.7	1.3	
Minimum	8.7	8.7	9.7		8.7	10.6	
Maximum	14.8	13.8	14.8		14.8	14.7	
% anaemic, lab reference *	50.0	77.3	33.3	0.001	67.6	19.0	<0.001
% meeting national referral guideline **	15.5	36.4	2.8	0.001	24.3	0	0.014
Males (n)	85	25	60		38	47	
Haemoglobin (g/dl):							
Mean	12.7	11.8	13.0		12.0	13.2	
Median	13.3	11.4	13.5		11.7	13.6	
Standard deviation	2.2	2.3	2.0		2.3	1.9	
Minimum	7.0	7.0	8.0		7.0	8.0	
Maximum	16.8	15.8	16.8		15.8	16.8	
% anaemic, lab reference *	48.2	64.0	41.7	0.060	60.5	38.3	0.041
% meeting national referral guideline **	23.5	44.0	15.0	0.004	36.8	12.8	0.009

* Lab reference, normal range 12-16 g/dl females, 13-18 g/dl males. Anaemia defined as Hb <12g/dl (females) and <13 g/dl (males).

** National referral guidelines, referral advised if Hb <10g/dl (females) or <11g/dl (males).