Citation for published version (APA):
Pallari, E., Fox, A., & Lewison, G. (2018). Differential Research Impact in Cancer Clinical Practice Guidelines’ Evidence-Base: Lessons from ESMO, NICE & SIGN. *ESMO Open BMJ*. https://doi.org/10.1136/esmoopen-2017-000258

Citing this paper
Please note that where the full-text provided on King’s Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher’s definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher’s website for any subsequent corrections.

General rights
Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the Research Portal

Take down policy
If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.
Differential research impact in cancer practice guidelines’ evidence base: lessons from ESMO, NICE and SIGN

Elena Pallari,1,2,3 Anthony W Fox,2 Grant Lewison3

ABSTRACT

Background This is an appraisal of the impact of cited research evidence underpinning the development of cancer clinical practice guidelines (CPGs) by the professional bodies of the European Society for Medical Oncology (ESMO), the National Institute for Health and Care Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN).

Methods A total of 101 CPGs were identified from ESMO, NICE and SIGN websites across 13 cancer sites. Their 9486 cited references were downloaded from the Web of Science Clarivate Group database, analysed on Excel (2016) using Visual Basic Application macros and imported onto SPSS (V.24.0) for statistical tests.

Results ESMO CPGs mostly cited research from Western Europe, while the NICE and SIGN ones from the UK, Canada, Australia and Scandinavian countries. The ESMO CPGs cited more recent and basic research (eg, drugs treatment), in comparison with NICE and SIGN CPGs where older and more clinical research (eg, surgery) papers were referenced. This chronological difference in the evidence base is also in line with that ESMO has a shorter gap between the publication of the research and its citation on the CPGs. It was demonstrated that ESMO CPGs report more chemotherapy research, while the NICE and SIGN CPGs report more surgery, with the results being statistically significant.

Conclusions We showed that ESMO, NICE and SIGN differ in their evidence base of CPGs. Healthcare professionals should be aware of this heterogeneity in effective decision-making of tailored treatments to patients, irrespective of geographic location across Europe.

INTRODUCTION

Clinical practice guidelines (CPGs) in oncology inform this expensive medical practice for the clinical care of patients with cancer. Use of CPGs has been shown to change clinical practice and improve the quality of patient care.1–3

The European Society for Medical Oncology (ESMO) was founded in 1975 and comprises a range of oncology stakeholders from 130 countries.4 In the UK, the National Institute for Health and Care Excellence (NICE), set up in 1999, provides evidence-based recommendations on healthcare practice in England and Wales.5 The Scottish Intercollegiate Guidelines Network (SIGN) was set up in 1993 by the Academy of Royal Colleges for the National Health Service in Scotland6 with wider consultation from professional and patient representative groups.7

Key questions

What is already known about this subject?

► Use of clinical practice guidelines (CPGs) has been shown to change clinical practice and improve the quality of patient care.
► Recommendations on CPGs should be based on the best available evidence; however, heterogeneity between development bodies has been demonstrated before.
► In this work, the research evidence base underpinning all the oncology CPGs published by European Society for Medical Oncology (ESMO), National Institute for Health and Care Excellence (NICE) and Scottish Intercollegiate Guidelines Network (SIGN) was assessed.

What does this study add?

► The differences are on national origins, time elapsed from publication to citation, research level (ie, basic or clinical) and research domain (eg, surgery, chemotherapy).
► The USA was the biggest contributor to the citations in the evidence base across all oncology CPGs.
► The ESMO CPGs cite mostly more basic research from Western Europe focusing on new chemotherapy agents or targeted treatments.
► The UK NICE and SIGN cite more clinical research from the UK, Canada, Australia and Scandinavian countries reporting more surgery.

How might this impact on clinical practice?

► This chronological difference in the evidence base is also in line with that ESMO has a shorter gap between the publication of the research and its citation on the CPGs.
► A closer collaboration between these professional bodies can lead to the use of more evidence-based, relevant and updated CPGs.
► Healthcare professionals using CPGs to personalise treatment regimens should be aware of these biases.
Recommendations on CPGs should be based on the best available evidence. An assessment of the research evidence base underpinning recommendations is important, as it demonstrates the degree of medical research transfer into practice. The mere assessment of the contribution of research papers by counting citations in the peer-reviewed literature does not reflect the impact of assimilation into clinical guidelines or implementation in care. The use of bibliometric analysis of CPGs addresses these gaps in understanding research activities, funding agenda and international collaboration in the cancer research arena, and guides public health policy.

Pentheroudakis et al challenged the research and clinical community to rethink CPGs’ heterogeneity almost a decade ago. Are CPG developers using similar evidence bases? Or are these different interpretations of similar evidence bases? Here, we evaluate the evidence base of oncology CPGs and consider the clinical impact they could have on the CPGs developed by ESMO, NICE and SIGN.

**METHODS**

Oncology CPGs (n=101) were collected from the ESMO, NICE and SIGN websites and downloaded, with a cut-off date of 8 April 2017 (for the methodology, see figure 1). For their citation details, see online supplementary appendix A – bibliography. Oncology CPGs were then classified using the ESMO system; this system has 13 major cancer types based on anatomical region or organ system (see table 1).

Each CPG citation was then downloaded as a full record from the Web of Science (this is a tab delimited text file format). These text files were then processed using Visual Basic Application programs (Evaluametrics, St Albans, UK).

*Figure 1* Flow chart of the used methodology adapted from Moher et al. ESMO, European Society for Medical Oncology; NICE, National Institute for Health and Care Excellence; SIGN, Scottish Intercollegiate Guidelines Network.
Table 1  The list of the cancer sites is presented in alphabetical order, as classified according to topic and title of each of the identified cancer CPGs (based on the cancer anatomy classification)

| No. | Cancer sites (CPG topic) | ESMO | NICE and SIGN | All |
|-----|--------------------------|------|---------------|-----|
| 1   | Breast cancer            | 4 (n=271) | 4 (n=966) | 8 (n=1237) |
| 2   | Cancers of unknown primary site | 1 (n=25) | 2 (n=217) | 3 (n=242) |
| 3   | CNS malignancies         | 1 (n=68) | N/A (n=0) | 1 (n=68) |
| 4   | Endocrine and neuroendocrine cancers | 4 (n=113) | N/A (n=0) | 4 (n=113) |
| 5   | Gastrointestinal cancers | 11 (n=522) | 5 (n=788) | 14 (n=1310) |
| 6   | Genitourinary cancers    | 6 (n=385) | 4 (n=1334) | 10 (n=1719) |
| 7   | Gynaecological cancers   | 5 (n=185) | 3 (n=486) | 8 (n=671) |
| 8   | Haematological malignancies | 14 (n=734) | N/A (n=0) | 14 (n=734) |
| 9   | Head and neck cancers    | 2 (n=24) | 1 (n=464) | 3 (n=488) |
| 10  | Lung cancer              | 10 (n=593) | 2 (n=561) | 12 (n=1154) |
| 11  | Sarcoma                  | 3 (n=184) | N/A (n=0) | 3 (n=184) |
| 12  | Skin cancer              | 1 (n=37) | 3 (n=450) | 4 (n=487) |
| 13  | Sequelae or other cancers | 13 (n=572) | 2 (n=507) | 15 (n=1079) |
| Total | 13 oncology areas     | 75 (n=3713) | 26 (n=5773) | 101 (n=9486) |

The table shows the allocation of the 101 ESMO, NICE and NICE CPGs for each cancer site and with the total number of references provided in brackets.

CNS, central nervous system; CPGs, clinical practice guidelines; ESMO, European Society for Medical Oncology; N/A, none available; NICE, National Institute for Health and Care Excellence; SIGN, Scottish Intercollegiate Guidelines Network.

England). For an example, see online supplementary appendix B. The CPGs from NICE and SIGN were grouped and compared with those from ESMO.

Unless stated below, independent sample, unpaired Student’s t-tests have been used to compare groups of citations or CPGs. The SPSS Statistics V.24.0 software was used for statistical hypotheses testing regarding: (1) country contribution in the evidence base; (2) publication year of cited research papers; (3) chronological research to reporting gap; (4) research level (RL) of the cited papers; (5) cancer research interests; and (6) cancer research domains.

Addresses of contributing authors were available for 9391 out of the 9486 research papers (99%). Multinational citations were calculated on a fractional basis. The publication year of the citation was used to establish the interval between cited research and date of CPG. Pivot tables were used to count published papers by year and organisational body.

For journal titles, the RL of the cited papers was calculated based on keywords in the title, and of the journals in which they were published, using the system of Lewison and Paraje. Each cited paper is given a single value on a scale from 1.0=clinical to 4.0=basic science. The same process was repeated to get the average RL for the journals in which these papers were cited. The mean RL for CPG citations was calculated by the following formula:

$$RL = \frac{(N(\text{clinical}) + 4N(\text{basic}) \times 2.5 \times N(\text{both}))}{(N(\text{clinical}) + N(\text{basic}) - N(\text{both}))}$$

The cancer sites application macro was used to allocate one or more of the 13 tumour sites to each citation. Some papers did not specify a site and were grouped under ‘Sequelae or other cancers’ together with very low frequency cancer sites.

The burden of disease was measured in disability-adjusted life-years (DALYs) for 2012 provided by the WHO. For each cancer site, this was taken as the percentage of total malignant neoplasm DALYs. Data on DALYs for sequelae, cancers of unknown origin, malignancies of the CNS, endocrine and neuroendocrine cancers, and sarcomas were grouped under ‘Sequelae or other cancers’, making the total of nine comparable groups by cancer site and disease burden.

The CPG citations were compared with the European oncology research papers, between 2002–2013. These were identified from the Web of Science using the Science Citation Index Expanded with a complex filter that contained 11 search statements; four listing 185 specialist journals in combination with seven listing 323 title words or phrases with no date restrictions.

RESULTS

There were 9486 citations in 101 CPGs. Distribution by cancer sites and CPG development body is summarised in Table 1.

Countries’ contributions in the evidence base

The USA was the biggest contributor to the citations in the evidence base across all oncology CPGs (see figure 2). Country ranks for the ESMO CPGs were then China and mostly Western Europe (Austria, Italy, Germany, France, Spain, Belgium, Switzerland and...
Poland). For the UK CPGs, the greatest country contribution following the USA, were the UK, Canada, Australia, Japan, Israel, South Korea, Taiwan, Italy, the Scandinavian countries (Denmark, Sweden and Finland) and Greece.

Inspection of the residual differences suggests that for NICE and SIGN, there is a positive skew towards literature from the UK and away from France, Spain, Belgium and Switzerland, as the most extreme examples of disproportionality.

**Publication year of cited papers**
The UK set of CPGs have a flatter distribution of citations than ESMO during the 22 year feasible period of observation (see figure 3).

**Research to reporting gap**
The greatest volume of cited references on ESMO CPGs (13.5%) have a very short reporting gap of only 1 year from when research was conducted to when cited in the guidelines, while those on the UK CPGs (10.5%) have a bigger gap of 4 years (results not shown). The cumulative percentages of the cited references with the gap in years are shown in figure 4. The mean gap of published research to reporting in a clinical guideline is 5.8 years for ESMO and 8.4 years for UK CPGs.

**RL of papers and journals of cited papers**
The mean RL of the journals was very similar between the ESMO and UK NICE and SIGN, and had a trend towards the basic, not the clinical, end of the scale. The difference in the results was not statistically significant (P > 0.05) in either CPG set.

In contrast to the journals, the majority of the oncology citations had an RL that was more clinical rather than basic, with a ratio of 10:1 for ESMO and 16:1 for UK CPGs (table 2). The differences in the average RL papers’ values between ESMO and NICE and SIGN were statistically significant between the CPG groups. The UK CPGs cited slightly more clinical research papers compared with the ESMO ones.

**Cancer sites application**
The citations were sorted based on the cancer site according to the anatomical or organ-specific classification (see Methods and figure 5). In total, there were nine malignant neoplasm sites (including ‘Sequelaer or other Cancers’) that could be compared with the disease burden measured in DALYs.

Overall, there was a better correlation between EU malignant neoplasm DALYs and cancer research output for ESMO than the UK (except for haematological cancers). There are three observed patterns when comparing research citations with disease burden (DALYs). The item...
Figure 3  The percentage (%) distribution of cited research papers by the year of their publication (solid boxes published between 2009 and 2015 for ESMO CPGs; open triangles, n=13 from NICE published in 2009–2015 and n=13 from SIGN published in 2005–2014). The cumulated difference between the 22 annual data points is statistically significant (P<0.05). CPG, clinical practice guideline; ESMO, European Society for Medical Oncology; NICE, National Institute for Health and Care Excellence; SIGN, Scottish Intercollegiate Guidelines Network.

Figure 4  The publication gap in years for the cumulative percent of cited research papers in the ESMO and the UK overall cancer clinical guidelines, with the difference between the two sets of data points being statistically significant (P<0.05). ESMO, European Society for Medical Oncology; NICE, National Institute for Health and Care Excellence; SIGN, Scottish Intercollegiate Guidelines Network.
Table 2  The research level of the cited papers and the cited journals they are published in (85% of all citations had enough data for analysis)

| References          | Clinical | Basic | Both | Total assessed | RL paper | Median RL journal | Mean RL journal |
|---------------------|----------|-------|------|----------------|----------|--------------------|-----------------|
| ESMO                | 3043     | 321   | 214  | 3150           | 1.20*    | 1.31               | 1.55            |
| UK NICE and SIGN    | 5259     | 324   | 244  | 4965           | 1.11*    | 1.27               | 1.41            |

*P<0.05 between CPG groups.
CPG, clinical practice guideline; ESMO, European Society for Medical Oncology; NICE, National Institute for Health and Care Excellence; RL, research level; SIGN, Scottish Intercollegiate Guidelines Network.

Cancer research domains

Table 2 shows the cited research for each of the 12 cancer research domains for the three sets of research papers: citations on EU ESMO CPGs, UK NICE and SIGN CPGs and European oncology research papers. The five main research domains were chemotherapy, targeted therapy, surgery, genetics and radiation therapy.

Chemotherapy was over-represented by a threefold in ESMO CPGs (29%) compared with the actual European output in oncology (11%) (P<0.01). The UK citations on CPGs are more proportionate (12%) as shown in figure 6.

For targeted therapies, a similar disproportion of the ESMO citations (12.3%) is observed, compared with 1.1% in the UK CPGs and 3.2% in the European output (P<0.01). The UK CPGs cite 2.5 times more research on surgery (27%) than ESMO (12.2%) or the EU output (12.8%) (P<0.01).

For radiation therapy, a statistically significant disproportion (P<0.05) is seen between the UK CPGs (14%), the European output (7%) and ESMO (10%). Finally, genetics research comprises a much higher proportion of the European oncology literature (19%) than the...
research citations in either ESMO (8%) or UK CPGs (6%) (P < 0.01).

**DISCUSSION**

Using proprietary macros, ESMO and the UK CPGs in oncology were compared on their underlying evidence bases. All oncology guidelines were influenced by research from the USA. The ESMO CPGs also appear to be influenced mainly by research from Western Europe. The UK CPGs development is influenced by research conducted in the UK itself, Scandinavian countries, Canada, Australia, Japan, Israel, South Korea and Taiwan.

During a 22-year period, the UK CPGs on cancer indicate a preference for older and more established clinical research in comparison with European guidelines that cite newer and experimental research. Out of the 12 cancer research domains, it is evident that ESMO CPGs favour research on chemotherapy and targeted treatments, while the UK NICE and SIGN ones emphasise surgery. The UK CPGs are slightly more clinical than the ones from ESMO, and focus on screening, radiotherapy or surgery, with the results being statistically significant.

There is a preference from ESMO on more recent research, which is especially evident from 2008 and a peak in 2012, prior to declining. In contrast, the UK NICE and SIGN development bodies present a delay in the uptake of more recent evidence in the guidelines with the research papers having a wider gap from publication to citation. This mismatch of research interests corresponds to that between academia on theoretical frameworks, and clinical practice. This temporal effect may also be because the ESMO cancer guidelines are more recent than the UK ones and cite newer research and hence, it is more likely that these research publications have greater international collaboration or even integrate more evidence-based recommendations.

Strategies of guidelines’ maintenance have been debated. To find common ground between producing a timely and scientifically valid and rigorous clinical guideline, a pragmatic methodological compromise is needed. A suggestion that the CPGs should be reassessed for validity every 3 years has been put forward and also challenged due to the use of a heterogeneous set of guidelines with variations in quality. This reporting preference can be perhaps justified that European cancer experts developing the ESMO CPGs cite research from Western Europe, as there are many Pan-European collaborations between the various institutions. An international collaboration is needed to exchange methodological information and avoid duplicated efforts.

One limitation of this work is that the assessment of references for classification used for the CPGs was based on a standard anatomical categorisation of the various
cancers as provided by the clinical guideline bodies. However, such grouping could hide recommendations based on genetic or gender differences in the population. This is pertinent to the use of CPGs that provide no substitute to the complex clinical decision-making processes.\(^{10-11}\) The systematic collection, analysis and presentation of references forming the evidence base of the cancer clinical guidelines from ESMO, NICE and SIGN highlighted in this work, can provide the prototype for further research on the assessment of individual cancer sites such as breast cancer or haematology.

This study demonstrates that CPG heterogeneity begins with heterogeneity of the evidence bases. We agree with a previous study\(^{19}\) that suggested that diverse guidelines might be needed to meet divergent demands. A previous study demonstrated that the percentage of the cited papers in 15 CPGs (different topics including cancer) from UK bodies were 36% from US papers and 25% from the UK, followed by Canada 7% and Japan 2%.\(^{11}\) This form of selective reporting bias is evident with other research that shows that the work of the UK, Denmark, Ireland and Sweden were overcited in UK oncology clinical guidelines.\(^{15}\) This is the first time that a similar influence is shown for the ESMO clinical guidelines.

There is a potential solution for bias that threatens validity in clinical research, when fixed rules restrict comprehensive systematic review.\(^{35}\) It is known that papers cited on clinical guidelines are very clinical rather than basic.\(^{10-11}\) A systematic methodology for clinical guideline development is regarded as demanding, causing guideline developers to revert to consensus-based or expert-based models instead.\(^{26-37}\)

Divergent demands may well justify this differential research impact in clinical guideline development. This study showed that ESMO, NICE and SIGN differ in their evidence base, and healthcare professionals should be aware of this heterogeneity when using CPGs as part of effective decision-making of tailored treatments to patients, irrespective of geographic location across Europe.

Acknowledgements The authors would like to thank Dr Philip Roe of Evaluameetrics Ltd, St Albans, England, for the Excel VBA programs.

Contributors Designed the study: EP. Carried out the literature review and developed the first draft: EP. Performed data quality check: all authors. All three line developers to revert to consensus-based or expert-based methods instead.

Competing interests None declared.

Provenance and peer review Not commissioned; internally peer reviewed.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

REFERENCES

1. Grimshaw J, Freemantle N, Wallace S, et al. Developing and implementing clinical practice guidelines. *Qual Health Care* 1996;5:55–64.
2. Grimshaw JM, Russell IT. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet* 1993;342:1317–22.
3. Bazian Ltd. Do evidence-based guidelines improve the quality of care? *Evidence-based Healthcare and Public Health* 2005;9:270–5.
4. European Society for Medical Oncology (ESMO). Welcome to ESMO, the European society for medical oncology. http://www.esmo.org/About-Us (accessed on 7 Jan 2017).
5. National Institute for Health and Care Excellence (NICE). What is SIGN? http://www.sign.ac.uk/about/introduction.html (accessed 27 Feb 2017).
6. Scottish Intercollegiate Guidelines Network (SIGN). A guideline developer’s handbook, 2015 http://www.sign.ac.uk/pdf/sign50.pdf (accessed 27 Feb 2017).
7. Twaddle S. Clinical practice guidelines. *Singapore Med J* 2005;46:681–6.
8. Straus SE, Sackett DL. Using research findings in clinical practice. *BMJ* 1998;317:339–40.
9. Grant J, Cottrell R, Cluzeau F, et al. Evaluating “payback” on bibliometric research from papers cited in clinical guidelines: applied bibliometric study. *BMJ* 2000;320:1107–11.
10. Lewison G, Wilcox-Jay K. 2003. Getting biomedical research into practice: the citations from UK clinical guidelines. *Proceedings of Ninth ISSI conference*, Beijing, China 152–60.
11. Shekelle PG, Ortiz E, Rhodes S, et al. Validity of the agency for healthcare research and quality clinical practice guidelines. *JAMA* 2001;286:1461–7.
12. Fervers B, Carrelier J, Bataillard A. Clinical practice guidelines. *J Visc Surg* 2010;147:e341–9.
13. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Med Care* 2001;39II:46.
14. Lewison G, Sullivan R. The impact of cancer research: how publications influence UK cancer clinical guidelines. *Br J Cancer* 2008;98:1944–50.
15. Sullivan R, Eckhouse S, Lewison G. Using bibliometrics to inform cancer research policy and spending. In: *Monitoring financial flows for health research* 2007, Geneva, Switzerland: Global Forum for Health Research, 2008:67–78.
16. Sullivan R, Lewison G, Purushotham AD. An analysis of research activity in major UK cancer centres. *Eur J Cancer* 2011;47:536–44.
17. Lewison G, Purushotham A, Mason M, et al. Understanding the impact of public policy on cancer research: a bibliometric approach. *Eur J Cancer* 2010;46:912–9.
18. Pentheroudakis G, Staelh R, Hansen H, et al. Heterogeneity in cancer guidelines: should we eradicate or tolerate? *Ann Oncol* 2008;19:2067–78.
19. European Society for Medical Oncology (ESMO). ESMO clinical practice guidelines. http://www.esmo.org/Guidelines (accessed on 7 Jan 2017).
20. National Institute for Health and Care Excellence (NICE). Browse guidance by topic. https://www.nice.org.uk/guidance/conditions-and-diseases/cancer (accessed on 8 Jan 2017).
21. Scottish Intercollegiate Guidelines Network (SIGN). Guidelines by topic. 2017 http://www.sign.ac.uk/guidelines/published/#Cancer (accessed on 8 Jan 2017).
22. World Health Organization (WHO). Health statistics and information systems- estimates for 2000-2012. 2012 http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html (accessed 27 Feb 2017).
23. Lewison G, Paraje G. The classification of biomedical journals by research level. *Scientometrics* 2004;60:145–57.
24. Health in Global Health: Global Burden Disease Estimates/En/index2.html (accessed 27 Feb 2017).
25. Lewison G. The publication of cancer research papers in high impact journals: MCB UP Ltd, 2003:55; 379–87. Aslib Proceedings.
26. Browman GP. Development and aftercare of clinical guidelines: the balance between rigor and pragmatism. JAMA 2001;286:1509–11.

27. Woolf SH, Grol R, Hutchinson A, et al. Clinical guidelines: potential benefits, limitations, and harms of clinical guidelines. BMJ 1999;318:527–30.

28. Fervers B, Burgers JS, Haugh MC, et al. Predictors of high quality clinical practice guidelines: examples in oncology. Int J Qual Health Care 2005;17:123–32.

29. Johnston ME, Brouwers MC, Browman GP. Keeping cancer guidelines current: results of a comprehensive prospective literature monitoring strategy for twenty clinical practice guidelines. Int J Technol Assess Health Care 2003;19:646–55.

30. Shekelle P, Eccles MP, Grimshaw JM, et al. When should clinical guidelines be updated? BMJ 2001;323:155–7.

31. Grol R, Cluzeau FA, Burgers JS. Clinical practice guidelines: towards better quality guidelines and increased international collaboration. Br J Cancer 2003;89(Suppl 1):S4–S8.

32. Philip T, Fervers B, Haugh M, et al. European cooperation for clinical practice guidelines in cancer. Br J Cancer 2003;89(Suppl 1):S1–S3.

33. Verkerk K, Van Veenendaal H, Severens JL, et al. Considered judgement in evidence-based guideline development. Int J Qual Health Care 2006;18:365–9.

34. Darling G. The impact of clinical practice guidelines and clinical trials on treatment decisions. Surg Oncol 2002;11:255–62.

35. Cervantes A, Pentheroudakis G, Arnold D. Critical evaluation of the scientific content in clinical practice guidelines. Cancer 2015;121:1907–8.

36. Burgers JS. Guideline quality and guideline content: are they related? Clin Chem 2006;52:3–4.

37. Grimshaw JM, Hutchinson A. Clinical practice guidelines--do they enhance value for money in health care? Br Med Bull 1995;51:927–40.

38. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 2009;6:e1000097.
Differential research impact in cancer practice guidelines' evidence base: lessons from ESMO, NICE and SIGN

Elena Pallari, Anthony W Fox and Grant Lewison

*ESMO Open* 2018 3:
doi: 10.1136/esmoopen-2017-000258

Updated information and services can be found at:
http://esmoopen.bmj.com/content/3/1/e000258

**References**

This article cites 27 articles, 6 of which you can access for free at: http://esmoopen.bmj.com/content/3/1/e000258#ref-list-1

**Open Access**

This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

**Email alerting service**

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Topic Collections**

Articles on similar topics can be found in the following collections

- Open access (191)

**Notes**

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/