



OPEN ACCESS

Discourses of prejudice in the professions: the case of sign languages

Tom Humphries,¹ Poorna Kushalnagar,² Gaurav Mathur,³ Donna Jo Napoli,⁴ Carol Padden,⁵ Christian Rathmann,⁶ Scott Smith⁷

¹Emeritus, Education Studies and Department of Communication, University of California at San Diego, La Jolla, California, USA

²Department of Psychology, Gallaudet University, Washington, DC, USA

³Department of Linguistics and Dean, Graduate School and Continuing Studies, Gallaudet University, Washington, DC, USA

⁴Department of Linguistics, Swarthmore College, Swarthmore, Pennsylvania, USA

⁵Division of Social Sciences, Department of Communication and Dean, University of California at San Diego, La Jolla, California, USA

⁶Section Deaf Studies and Sign Language Interpreting Humboldt-Universität, Berlin, Germany

⁷Office of the President, National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, New York, USA

Correspondence to

Professor Donna Jo Napoli, Department of Linguistics, Swarthmore College, Swarthmore, PA 19081, USA; donnajonapoli@gmail.com

Received 11 November 2015

Revised 15 September 2016

Accepted 13 February 2017

ABSTRACT

There is no evidence that learning a natural human language is cognitively harmful to children. To the contrary, multilingualism has been argued to be beneficial to all. Nevertheless, many professionals advise the parents of deaf children that their children should not learn a sign language during their early years, despite strong evidence across many research disciplines that sign languages are natural human languages. Their recommendations are based on a combination of misperceptions about (1) the difficulty of learning a sign language, (2) the effects of bilingualism, and particularly bimodalism, (3) the bona fide status of languages that lack a written form, (4) the effects of a sign language on acquiring literacy, (5) the ability of technologies to address the needs of deaf children and (6) the effects that use of a sign language will have on family cohesion. We expose these misperceptions as based in prejudice and urge institutions involved in educating professionals concerned with the healthcare, raising and educating of deaf children to include appropriate information about first language acquisition and the importance of a sign language for deaf children. We further urge such professionals to advise the parents of deaf children properly, which means to strongly advise the introduction of a sign language as soon as hearing loss is detected.

INTRODUCTION

It is settled science that sign languages are natural human languages. Any suggestion that learning a sign language will be cognitively harmful to deaf children, and any social or educational recommendations based on such a suggestion, are prejudicial in that they are unfavourable positions arrived at without knowledge or reason. (Note: we use the term *deaf* inclusively to cover a range of hearing loss, from no residual hearing to hard-of-hearing.) Such statements must be challenged scientifically, ideologically and ethically. Prejudices regarding sign languages are harmful to society as a whole and, in particular, to deaf children.

Some spoken languages have been considered inferior during various times in history, particularly those associated with people who were considered inferior. Likewise, in many places, deaf people have been subjected to patriarchal behaviours that reveal overt and covert individual and institutional prejudice, particularly against sign languages.¹

While we recognise today that prejudices against individual languages may not have completely disappeared despite the findings of the cognitive sciences, a critical junction exists at this time among those who persist in thinking that learning a

sign language can be cognitively harmful. By any ethical standards, no well-respected, educated professional would claim that learning any specific spoken language would be cognitively harmful for anyone. Yet, uninformed and unscientific beliefs about sign language and about language in general remain the basis of many statements by professionals who believe that deaf children should not be exposed to sign language, and these beliefs have led to the present standard of care, in which deaf children receive a cochlear implant (CI) and are raised exclusively orally (at least until that approach fails with the individual child).

An example of bias in research regarding sign language is the attribution of CI failure to the use of sign: ‘... studies of deaf children have demonstrated that (when) CI is less effective. (it) appears to be related at least in part to communication through sign language, because of cortical reorganization of the auditory cortex’ (see refs. 2 and 3 for full discussion of this particular bias).

Prejudices like this are expressed frequently online. For example, a paediatric audiologist claims that a spoken language and American Sign Language (ASL) cannot be learned simultaneously: ‘The two languages have different grammars. Tense is expressed differently, and word order is different. Children can learn both, but not together. We know that.’⁴ Who knows that? Japanese and Mandarin have different word order and ways of expressing tense, but many children learn them simultaneously. Hearing children of deaf adults grow up learning a sign language and a spoken language simultaneously without problem. Some deaf children do as well.⁵

These prejudices litter the Internet when something relevant and newsworthy happens, as in the flurry of activity in Spring 2016, when Nyle DiMarco was a contestant on ABC’s ‘Dancing with the Stars’. In an article in *The Washington Post*, DiMarco advocated that all deaf children learn to sign. The Alexander Graham Bell Association responded with the claim: ‘Recent studies show that children who solely utilize listening and spoken language, rather than a combination of this with ASL, demonstrate better listening and spoken language skills than do children who follow a combination approach ...’ No citation to such studies appears (and we know of none). In an article in *The New York Times*, a parent reports on this controversy with respect to her deaf son, where a speech therapist warned against sign since it would be ‘a crutch’ inhibiting speech.⁶

These prejudices are also expressed in meetings between medical professionals and parents, causing

To cite: Humphries T, Kushalnagar P, Mathur G, et al. *J Med Ethics* Published Online First: [please include Day Month Year] doi:10.1136/medethics-2015-103242

Gallaudet University and the National Technical Institute for the Deaf at Rochester University to address them explicitly in their materials for parents, and causing the rise of Internet sites such as Deafed.net. Prejudicial remarks are also reported on in publications by those concerned with the health/education of deaf children.⁷ The National Association of the Deaf's response to a 2015 *Paediatrics* article says, 'Most families with deaf children are persuaded by misguided professionals to pursue listening and speaking only and to exclude the use of American Sign Language (ASL) ...'⁸

We offer the following discussion as a new way to think about sign languages and deaf people that focuses on areas of ideological and professional disagreement fuelled by misunderstandings that can influence how professionals interpret scientific information.

DIFFICULTY OF LEARNING SIGN LANGUAGES

Many people who have no or minimal experience with sign language users, including (new) parents of deaf children and the professionals who advise them, have fears about the difficulty of learning a sign language. Certainly, they might lack the resources or infrastructure to do so—an important but separate issue. What concerns us here is that they might initially assume they are incapable of learning to sign well enough to be able to help their child's language development. The same paediatric audiologist's website mentioned earlier says, 'Parents who do not know sign language well cannot provide a rich language environment for their child'.⁴ With little prior knowledge of signing, parents and professionals are vulnerable to a bias against bringing a sign language into the lives of children who, in fact, could benefit greatly from visual-manual language during a critical time for language and cognitive development.

Certainly, learning a second language as an adult is challenging, but no scholarly study has yet to find that sign languages are more difficult. Motivation is an important component in all second language learning, and parents who find themselves with a deaf child are likely to have strong motivation due to an impulse to communicate with their child in effective ways.

The fear that parents cannot learn to sign well enough to serve as good language models for their children should be put aside: parents do not have to be the most fluent signing models for their children. Deaf children, if exposed to good signing models outside the family, will learn to sign well even if their parents are less than fluent.⁹ Moreover, deaf children whose parents are able to communicate with them with sign language benefit in other ways: they use more complex language with one another with more positive outcome than those who do not sign at all,¹⁰ and they show early language expressiveness on a par with hearing children of the same age.¹¹ With language-learning support (a teacher, tutor, other signers, the child's deaf peers and the parents), family members learning a sign language, for example, ASL or German Sign Language (DGS), at the same time as the deaf child, powerfully enhance family communication and promote a typical language acquisition process, which is key for the child's lifelong success.

BIMODAL BILINGUALISM

Bilingualism

There are many questions about how a sign language and a spoken language interact in the same person, whether one interferes with the learning of the other or whether they, instead, work together to foster language and cognitive development in deaf children to a greater extent than either language alone. For

these reasons, bimodal bilingualism is an important consideration in discussions of deaf children's development.

There is robust evidence that small children (from infants through preschoolers) have an extensive capacity to learn multiple languages with cognitive benefits. Indeed, about 25% of young children in the USA are dual or multiple language learners, and the percentage is higher in Europe and other continents. While the term *bilingualism* applies to many different linguistic situations, no study of any type of bilingualism has yet presented evidence or even suggested that any particular spoken language or type of spoken language differs from others with respect to the issue of potential cognitive benefits. If a scholar of language were to claim that learning Spanish, for example, cognitively harmed a Chinese child or a Navajo child or a child with any other spoken language at home, the claim would be considered prejudiced by other scholars.

Bimodality

It is common for medical professionals, who are often the first source of advice for parents of deaf children, to claim that learning a sign language will interfere with a deaf child's learning a spoken language, because a sign language is not perceived and produced in the auditory-vocal modality.¹² What is the basis for making such a claim?

Sign languages are produced and understood with use of gesture and vision. When one learns two languages such as ASL and English, or DGS and German, one is using two languages in two different modalities. Deaf children are able to fully access sign languages visually while they are often not able to fully access spoken languages aurally. That said, there is growing research evidence that learning to sign, rather than interfering with deaf children's speech, instead enhances it.¹³ Signing abilities correlate with better speech in children with CIs who are exposed to frequent signing from birth.⁵ Signing nourishes the language mechanism during the period prior to CI, so that the child approaches speech without delay in language development. The presence of sign language in the child's environment provides a path to language and cognitive development that enhances even spoken language development.

SIGN LANGUAGES, WRITTEN REPRESENTATION AND ORALITY

Another source of prejudice is based on the persistent misconception that the written form of a language is the superior one, the one worthy of study, and this bias permeates individual and institutional attitudes. Sign languages have historically had no printed form of wide usage; thus, they would be deemed unworthy of study. This logic makes them inferior to spoken language and promotes the idea that they are a 'last resort' if the deaf child 'fails' at speech.

The disparagement of languages without writing systems is as absurd as it is prejudicial, since literacy takes many forms, print literacy being only one. For example, oral literacy is well researched in Australia, Africa, the Americas, the steppes of Russia and so on. Likewise, orality is not necessary for literacy: story-telling and poetry in sign languages are found around the globe. If one views literacy as strictly being about print, we discard much of what is involved in learning to read, such as world knowledge, comprehension abilities, and understanding narrative form and characterisation.

SIGN LANGUAGES AND PRINT LITERACY

Ample studies have shown that fluency in a natural sign language leads to better print literacy skills in the text of the

ambient spoken language (ref. 14, among many on several sign language/spoken language–text pairings). Such studies counter prejudicial perceptions that there is no positive relationship between a sign language and print literacy. If researchers and professionals can stick to identifying and developing factors that promote (or hinder) print literacy without fears about imagined negative effects of sign languages, a discourse of prejudice can be avoided. The development of print literacy is a clear goal of everyone in deaf-related research and professions, and ideological positions that denigrate the contributions of a sign language to the achievement of this goal make children suffer harm from zero tolerance to alternative approaches.

SIGN LANGUAGES AND HEARING TECHNOLOGIES

Hearing children are, quite generally, left to acquire language fairly unencumbered by interventions and heroic concern. When hearing is absent from the child, however, society has reacted during much of history by trying to find ways to restore or insert it, subjecting children to wide-ranging innovations and inventions, procedures and practices, and technologies of hearing, from hearing aids to CIs, in an effort to expose them to speech. Such efforts have proven successful for some, but not for the majority.

For many professionals who do not have expertise in deaf children's language development, scientific data about deaf children's experiences with CI might seem appealing. They place their confidence in technological advances. However, while advances in technologies are largely due to new understandings in technology itself, a CI also requires a sophisticated understanding of the human brain, which we have not yet fully arrived at.

CI outcomes vary, with a significant number of treatment failures.¹⁵ More to the point, CI technology varies greatly in its benefit to speech detection and development.¹⁶ Furthermore, studies of children with CIs sometimes attribute their variable speech abilities to interference from sign language; yet, that claim is without foundation.³

The issue is that, without sign language, CI treatment failures usually result in significant linguistic deprivation and subsequent lifelong cognitive dysfunction (ref. 17, among many). In contrast, learning a sign language with a similar level of effort as that afforded to deaf children who are training to use a CI guarantees normal language development and promotes cross-language processing.¹⁸

The emergence of CI technology has given rise to the re-emergence of prejudiced efforts to exclude sign languages from deaf children's lives. These efforts blame sign languages for limiting the effectiveness and efficiency of implant technology by interfering with the processing of technologically supplied input to the child's brain.

It is instructive to examine one example of a study that claims to offer evidence that signing hinders the acquisition of speech once a child is implanted. Rather than cherry-picking a weak study, we choose a study that has been cited multiple times and in well-respected journals, and show that it does not, in fact, support that claim.

Geers, Spehar and Sedey studied children who had been implanted before age 5 and had been enrolled in a sign and speech setting (called Total Communication) for at least the first 3 years following implantation.¹⁹ They found a wide range of results with respect to modes of communication among the children. They concluded children who used speech the most achieved higher auditory speech perception scores and speech

intelligibility ratings and demonstrated better use of grammatical English than those who used little to no speech.

What other possible conclusions can be drawn from this study? First, in a Total Communication setting, no children are denied signing. The findings of the study do not, then, suggest that signing interferes with speech development or even that reliance on sign has a negative effect on a child's spoken language skills. Rather, we do not know from this study how much any individual child was using sign language as a means of negotiating speech encounters.

More to the point, since CI technology varies so greatly in benefit to speech detection and development, it is not clear how the Geers, Spehar and Sedey study distinguishes between the variable speech detection of CI users and their variable fluency in sign language in attributing cause to variation in speech use and development. Without clarity in reporting use of either sign language or speech, this is where bias appears in the form of blaming sign languages for effects that the evidence does not support.

Finally, if we suppose that the study's claim is true—and children who use speech the most achieve higher auditory speech perception scores and speech intelligibility ratings and demonstrate better use of grammatical English—we must ask which way the causal arrow points. Geers, Spehar and Sedey interpret this as showing that practising speech leads to better speech perception, and therefore as supporting the advice that sign should not be encouraged. But it might instead show that those with better speech perception find it more rewarding to practise speech, in which case introducing sign would not be contraindicated.

Given that this is one of the most respected studies, it is no surprise that a recent metastudy concludes there is no evidence that signing hinders the acquisition of speech in implanted children.²⁰

SIGN LANGUAGE AND FAMILY RELATIONSHIPS

A common fear of parents is that if their deaf children learn sign language, their children will drift away from the family and become part of a social world of deaf signers, a deaf culture. The opposite has been shown to be true. Deaf children who grow up bilingually and are able to communicate with their parents in a sign language (and in a visual modality) are much more likely to have strong, healthy family ties than those deaf people who are unable to speak well or hear well enough to communicate with their parents because neither they nor their parents learned a sign language.²¹ There are reports indicating that some oral deaf people and hearing parents of deaf children wish they had had an opportunity to learn sign language earlier but were advised against doing so.²² One of the comments to the *Post* article on DiMarco ended with the bleak statement, 'I was a victim of oral monolingual education'.

In their social world (or shared culture), deaf people view themselves as whole, well and empowered. In contrast, the medical profession views deaf people as having a medical condition or pathology that they are obligated to address through medical means. Likewise, professions such as audiology and hearing sciences see it as their duty to provide treatments, therapies and interventions. Educators design pedagogy that is special or differentiated from that of other children. This combination of historical negative view of deaf people in society and the professions often communicates to parents that if they allow their deaf children to learn a sign language, their children will identify with this community and not the family. But denying both dimensions of identity (as a signing deaf person and as

part of a hearing family) has a greater chance of harm to the deaf child and the family than recognising and integrating both identities and cultures into the family.

Deaf and hard-of-hearing youth who report a preference for both sign language and spoken language experience less stigma associated with being deaf or hard-of-hearing compared with other deaf or hard-of-hearing youth who prefer using solely sign language or spoken language.²³ The ability of deaf children to communicate effectively and easily with others is critical to mental health.²⁴ Parents who choose to use spoken language only with their deaf child run a high risk of their child seeking social ties where they can communicate more easily (usually with other deaf adults). Advising parents to avoid signing in order to ensure family relationships is illogical and prejudiced. Hearing parents and deaf children being bilingual in a spoken and a sign language is the most positive, supportive and lasting relationship builder in such families.

There is persistence of thinking about deaf people as having a pathology, whether it is a condition of the ear or a disorder of communication, and there is also insistence on viewing deaf people's bodies as unwell. Since the 1970s, however, there has been a great surge of rethinking about deafness and sign languages with the result that we now recognise that deaf people using a sign language form cohesive and rich linguistic communities much like the linguistic communities of spoken language users. In other words, deaf people are well and have fully constituted ways of being.

CONCLUSION

This paper has sought to point out prejudices among researchers and professionals in an effort to better ourselves and our professions. We are a group of mostly deaf researchers and professionals who have first-hand experience and knowledge when it comes to understanding language in general, sign languages, cultures and deaf people's lives. It is time for the professions who interact with deaf children and their families to

- ▶ update their thinking about the integrity of sign languages,
- ▶ meet the obligations of professionalism to keep abreast of current literature in the journals and not allow the manufacturers of CIs to be their main source of information,
- ▶ examine their own discourse in interactions with families and deaf people and in professional interactions and publications
- ▶ have a well-thought-out articulation of the limited scope of one's knowledge as a medical professional, including when to refer to or consult experts in other domains, and how to adjudicate potential overlap or conflicts of expertise.

Sign languages are valuable to society and to the diversity of this planet. We must get beyond the supreme irony of considering sign languages possibly helpful to babies who hear, beautiful when we see them on stage, fun to learn and enlightening about the nature of human cognition, while discouraging their use by deaf babies. And we must question research when it tries to attribute harm to learning a natural human language.

The prejudice that exists against sign languages among researchers and professionals who assert that learning a sign language is somehow detrimental to the deaf child does not stand up to massive evidence collected over a long period of time.²⁵ This prejudice can be avoided by recognising that sign languages, like other languages, are not the cause of whatever effect or pathology may be discovered in the course of research. Since this prejudice may arise out of ignorance due to not having an opportunity to learn about sign languages in graduate or professional school, we stress the importance of including

sign languages and basics of language acquisition in the curriculum of medical education and other graduate programmes and in continuing medical education programmes. In the absence of prejudice against sign languages, advice for parents of deaf children must include introducing a sign language as soon as hearing loss is detected.

Contributors All coauthors have made substantial contributions to the conception of this work and to drafting or revising it for content. All gave final approval of the published version and are accountable for all aspects of the work related to accuracy and integrity.

Competing interests None declared.

Provenance and peer review Not commissioned; externally 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 Lane H. *The mask of benevolence: disabling the deaf community*. New York: Knopf, 1992.
- 2 Charroó-Ruiz LE, Picó T, Pérez-Abalo MC, *et al*. Cross-modal plasticity in deaf child cochlear implant candidates assessed using visual and somatosensory evoked potentials. *MEDICC Rev* 2013;15:16–22.
- 3 Campbell R, MacSweeney M, Woll B. Cochlear implantation (CI) for prelingual deafness: the relevance of studies of brain organization and the role of first language acquisition in considering outcome success. *Front Hum Neurosci* 2014;8:1–11.
- 4 Madell J. The spoken language vs ASL debate is back. Hearing Health & Technology Matters. <http://hearinghealthmatters.org/hearingandkids/2016/spoken-language-vs-asl-debate-back/> (accessed 9 Sep 2016).
- 5 Davidson K, Lillo-Martin D, Chen Pichler D. Spoken English language development in native signing children with cochlear implants. *J Deaf Stud Deaf Educ* 2014;19:238–50.
- 6 Donvito T. Parents of deaf children, stuck in the middle of an argument. *The New York Times* 24 May 2016. http://well.blogs.nytimes.com/2016/05/24/parents-of-deaf-children-stuck-in-the-middle-of-an-argument/?_r=1 (accessed 11 Sep 2016).
- 7 Krammer K. The benefits of sign language for deaf children with and without cochlear implant(s). *Eur Sci J* 2013;4:341–9.
- 8 Rosenblum HA, Wagner CD. Ethics rounds was right on point. *Pediatrics* 2015;136:e1487–8.
- 9 Singleton JL, Newport EL. When learners surpass their models: the acquisition of American Sign Language from inconsistent input. *Cogn Psychol* 2004;49:370–407.
- 10 Jamieson JR. Visible thought: deaf children's use of signed & spoken private speech. *Sign Language Studies* 1995;86:63–80.
- 11 Spencer PE. The expressive communication of hearing mothers and deaf infants. *Am Ann Deaf* 1993;138:275–83.
- 12 McConkey A. Rehabilitation after cochlear implantation. In: Niparko J, ed. *Cochlear implants: Principles & practices*. Philadelphia/Baltimore: Wolters Kluwer, 2009:269–312.
- 13 Hassanzadeh S. Outcomes of cochlear implantation in deaf children of deaf parents: comparative study. *J Laryngol Otol* 2012;126:989–94.
- 14 Clark D, Hauser P, Miller P, *et al*. The importance of sign language acquisition for deaf readers. *Reading & Writing Quarterly* 2014:1–25.
- 15 Pisoni DB, Conway CM, Kronenberger WG, *et al*. Efficacy and effectiveness of cochlear implants in deaf children. In: Marschark M, Hauser PC, eds. *Deaf cognition: foundations and outcomes*. Oxford: Oxford University Press, 2008:52–101.
- 16 Humphries T, Kushalnagar P, Mathur G, *et al*. Cochlear implants and the right to language: ethical considerations, the ideal situation, and practical measures toward reaching the ideal. In: Umat C, Tange RA, eds. *Cochlear implants research updates*. InTech, 2012:193–212.
- 17 Mayberry RI, Chen JK, Witcher P, *et al*. Age of acquisition effects on the functional organization of language in the adult brain. *Brain Lang* 2011;119:16–29.
- 18 Ormel E, Giezen M. Bimodal bilingual cross-language interaction: Pieces of the puzzle. In: Marschark M, Tang G, Knoors H, eds. *Bilingualism and bilingual deaf education*. New York/Oxford: Oxford University Press, 2014:74–101.
- 19 Geers A, Spehar B, Sedey A. Use of speech by children from total communication programs who wear cochlear implants. *Am J Speech Lang Pathol* 2002;11:50–8.

- 20 Fitzpatrick EM, Hamel C, Stevens A, *et al.* Sign language and spoken language for children with hearing loss: a systematic review. *Pediatrics* 2016;137.
- 21 Calderon R, Greenberg M. Social and emotional development of deaf children: family, school, and program effects. In: Marschark N, Spencer PE, eds. *The Oxford Handbook of Deaf Studies, Language, and Education*. Vol. 1. Oxford: Oxford University Press, 2011:188–99.
- 22 McKee R, Vale M *Parents of deaf and hearing impaired children: Survey report. The vitality of New Zealand Sign Language project*. Wellington, NZ: Deaf Studies Research Unit, Department of Linguistics and Applied Language Studies, 2014. <http://www.victoria.ac.nz/lals/centres-and-institutes/dsru/NZSL-Vitality-Parent-Survey-Report-March-2014.pdf>015 (accessed Nov 2015).
- 23 Kushalnagar P, Topolski TD, Schick B, *et al.* Mode of communication, perceived level of understanding, and perceived quality of life in youth who are deaf or hard of hearing. *J Deaf Stud Deaf Educ* 2011;16:512–23.
- 24 Fellingner J, Holzinger D, Pollard R. Mental health of deaf people. *Lancet* 2012;379:1037–44.
- 25 Swanwick RA. Deaf children's bimodal bilingualism and education. *Lang Teach* 2016;49:1–34.



Discourses of prejudice in the professions: the case of sign languages

Tom Humphries, Poorna Kushalnagar, Gaurav Mathur, Donna Jo Napoli,
Carol Padden, Christian Rathmann and Scott Smith

J Med Ethics published online March 9, 2017

Updated information and services can be found at:

<http://jme.bmj.com/content/early/2017/03/09/medethics-2015-103242>

These include:

References

This article cites 14 articles, 2 of which you can access for free at:
<http://jme.bmj.com/content/early/2017/03/09/medethics-2015-103242>
#BIBL

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](#) (111)

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/>