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Introduction

Medical research funders, including charities, were amongst some of the earliest advocates and adopters of open access (OA). In the USA, the National Institutes of Health (NIH), and in the UK, the Wellcome Trust, were active in the OA debate as early as 2002. NIH launched a formal OA policy in 2004 and Wellcome in 2005, both requiring their grant-holders to make their research outputs openly accessible. The publicly funded Medical Research Council (MRC) in the UK followed with an OA policy in 2006, and several UK charities introduced policies soon after: Arthritis Research UK, Cancer Research UK, and the Myrovlytis Trust all introduced OA policies in 2007. These developments served to create and reinforce the strong association between medical research funders and OA. However, much of the commentary to date on the particular relationship between charities in the medical research area and OA has tended to focus on specific organizations which have been prominent in public discussions, such as Wellcome. The positions of a wide range of charity organizations within the sector have not been systematically investigated. This research study aims to go some way to correcting that by providing a current view of the sector-wide situation in the UK.

This is particularly relevant at present. The last two years have witnessed some major OA developments which between them are likely to bring OA into the mainstream of research publishing and dissemination for many disciplines – developments to which medical research charities need to respond. In the UK, the publication of the Finch Report (in June 2012),¹ followed by new OA-related policies from Research Councils UK (in July 2012 and revised in March 2013),² and the Higher Education Funding Council for England (published as an initial statement in July 2012 and then a consultation in February 2013),³ are all highly significant developments. In Europe,

Medical research charities and open access

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ABSTRACT. This paper provides an analysis of the attitudes and activities of UK medical research charities in relation to open access (OA). Both quantitative and qualitative data are presented derived from a recent survey of charities covering areas such as policy development, funding arrangements, and business process design for OA. Positions on key issues including green and gold OA, funding article-processing charges (APCs), and publication licences are assessed. Modelling of potential APCs as a percentage of overall annual research spend is undertaken to show possible costs of a charged-for gold system. Medical research charities clearly regard OA as important and some see it as an opportunity to further their mission. However, many expressed significant concerns particularly about the costs and expertise required to support OA. Further co-ordination of policy development and action across the sector and with other stakeholders is recommended in order to help ensure optimal implementation of OA.



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other countries are also moving ahead with new OA policies, and at a Europe-wide level, the European Commission adopted a new OA policy in July 2012.⁴ In the USA, the Federal Fair Access to Science and Technology Research (FASTR) bill was announced in February 2013, and the Office of Science and Technology Policy (OSTP) also published its OA policy memorandum the same month.⁵ Elsewhere, the Australian Research Council introduced a new OA policy in January 2013.⁶ These and similar developments have created a climate in which medical research charities are developing and reviewing their own positions and policies.

In the context of these developments, the research reported here was designed to investigate the attitudes and activities of UK medical research charities and other related medical research funders in relation to OA, specifically:

1. To enable a better understanding of the current landscape of medical research charities and related organizations and their attitudes to OA in order to inform policy discussions
2. To capture data in key areas of activity, including current funding levels, numbers of research outputs, and article-processing charges (APC) payment levels, in order to understand the current situation
3. To surface major concerns charities currently have with OA, and their views on opportunities OA creates, and how these relate to their mission and affect their donors and beneficiaries
4. To identify actions which may address current concerns and exploit opportunities, and recommend how these might be implemented by key players

The research was overseen by a Stakeholder Group consisting of representatives from the Association of Medical Research Charities (AMRC) and Europe PubMed Central (Europe PMC) whose members were the target group for the research. The AMRC is a UK membership organization consisting of 124 medical and health research charities with an organizational mission 'to support the sector's effectiveness and advance medical research by developing best practice, providing information and guidance, improving

public dialogue about research and science, and influencing government'.⁷ Its members include trusts, funding their work from investments or endowments, and fund-raising bodies, which raise money from donations. The size of the organizations varies, from those reporting expenditure on medical research as low as £10,000 per year to as high as over £500 million. A number of AMRC members are also funders of Europe PMC. Europe PMC is the European implementation of the larger PubMedCentral repository containing high-quality biomedical resources, including published research outputs. When this research was undertaken, Europe PMC had 17 UK funders, 13 of whom are also members of the AMRC. The small number of UK organizations in Europe PMC who are not members of AMRC are government-sponsored agencies rather than charities.

Literature review

The case for open access has often been made in terms of potential medical benefits.⁸ This view clearly informed the developments of medical research funders. For example, in one of its early policy documents, NIH refers to the potential for an 'acceleration of medical cures' created by OA.⁹ Subsequent qualitative work carried out to test this hypothesis on behalf of NIH has shown positive results,¹⁰ although obtaining clear quantitative results on this may be challenging.

Whilst this view may have underpinned a number of OA policy implementations, the thinking of funders has not been widely documented except in the case of a small number of large funders. For example, Terry,¹¹ Pinfield,¹² and Walport and Kiley¹³ have described the position of the Wellcome Trust at various times. In their 2006 paper, Walport and Kiley as Director of the Wellcome Trust and Head of eStrategy, respectively, outline a number of issues which feature in the research reported here. Initially, they highlight some of the circumstances which gave rise to the Trust's OA policy including an exercise which showed that only 6% of articles reporting Wellcome-funded research were freely available on the Web. They then summarize the Wellcome policy which came into effect in October 2006 requiring authors to make their

the AMRC is a UK membership organization consisting of 124 medical and health research charities

papers freely available via PubMed Central. They specify a number of benefits their policy is expected to deliver, including increasing opportunities for researchers' work to be more widely read and cited, enabling linking and integration of resources (e.g. linking publications with chemical compound databases), helping funding bodies to evaluate research, and facilitating the preservation of research. They describe their preference for 'gold' OA (OA publication in journals), including the business model involving payment of APCs. Developments such as these have contributed to the growth of gold OA in particular in biomedicine.¹⁴ Were the Trust to fund all papers which cite the Wellcome as a funder, Walport and Kiley estimate it would cost around 1.5% of their total research spend, although with the funding of many research projects shared with other funders, this percentage would be expected to fall as others adopt OA policies. As well as funding APCs, they also describe the Wellcome's investment in creating a version of PubMed Central in the UK, a service which in its expanded form, Europe PMC, has now been supported by a number of other funders in the biomedical field.

Other charities have made their OA policies publicly available on their websites, many of which also require deposit in Europe PMC. Many allow 'green' OA (the depositing of versions of papers in OA repositories) as well as gold, although the emphasis given to each varies. For example, Arthritis Research UK includes on its website a step-by-step guide for authors describing various ways in which its grant-holders can make their papers OA.¹⁵ The guide describes the organization's requirement for papers to be made OA within six months of publication on Europe PMC, how authors can if appropriate 'self-archive' in Europe PMC, and how the charity will support the payment of APCs in certain circumstances.

Whilst a number of organizations have released similar policies, there is little published literature describing their thinking or attitudes to OA. Some of this can be garnered from other sources, however, including evidence recently submitted to various UK Parliamentary investigations of open access. In its written evidence to the House of Commons Select Committee on Business,

Innovation and Skills, for example, Cancer Research UK stated: 'Cancer Research UK supports the goals of open access (OA) as we believe that making the results of research widely and freely available can only benefit the research effort and the economy.'¹⁶ The organization signalled its preference for the gold route but questioned whether charities should pay APCs. It stated that payments of APCs should be covered as an indirect cost of research along with other infrastructure and overhead costs rather than as part of direct research grants. In the UK, indirect costs for charity-funded research are paid by government via the Charity Research Support Fund.

Submitting evidence to the same Select Committee enquiry, the Wellcome Trust also commented on the important issue of the *level* of openness associated with OA as defined in licences. It stated its support for the use of the CC-BY (Creative Commons attribution) publication licence which allows the unrestricted reuse of material: 'Our move to require CC-BY licence flows from our firm belief that the full research and economic benefit of published research will only be realised when there are no restrictions on access to, and re-use of, this information.'¹⁷ It quoted the example of text mining which may not always be permitted even for OA content under certain more restrictive licence conditions.

These and other key issues have, of course, been widely discussed and debated in the general OA literature and other fora. Organizations like the Wellcome have contributed to this wider debate, including commissioning early research on the potential costs of an OA research communication system¹⁸ and more recent work modelling costs of different approaches to OA.¹⁹

Research design

The research reported here was designed to address a number of key issues arising from the literature as well as current practice. It was aimed at members of AMRC and Europe PMC who were asked to respond on behalf of their organizations, and took the form of an online questionnaire divided into a number of sections covering:

- organizational policies in relation to OA;

the research reported here was designed to address a number of key issues

- attitudes to various approaches to the implementation of OA;
- funding arrangements for OA;
- challenges, opportunities and concerns created by OA.

The questionnaire consisted of a total of 21 questions, although not all questions were designed to be answered by all respondents because of routing between questions dependent on previous responses. The questionnaire comprised a combination of closed questions intended to produce quantitative data on specific issues, and open questions designed to generate qualitative data from free-text comments. Mandatory questions were kept to a minimum in order to encourage as many responses as possible.

Following ethics approval granted as part of the University of Sheffield research ethics process, the questionnaire was piloted between 6 and 11 March 2013. Piloting led to a number of amendments being made to the questionnaire to improve clarity and to ensure that it took only between 10 and 20 minutes to complete (depending on the extent to which free-text comments were added by respondents) in order to maximize responses. The final version of the questionnaire was made publicly available between 12 March and 16 April 2013. Invitations to participate were distributed by email by AMRC and Europe PMC to their members. These included an initial invitation on 12 March 2013, followed by a reminder on 25 March 2013.

Findings

Fifty-six responses to the survey were received. These included 50 complete responses plus 6 incomplete responses but which included usable data. Of the 56 responses, 14 were from Europe PMC members, 12 of them from the UK (11 also being AMRC members). The two non-UK responses were eliminated from the analysis in order to create a coherent UK-specific results set. However, the one UK non-AMRC response was included in the analysis since it came from a closely allied organization. There were, therefore, a total of 54 usable responses to the questionnaire as a whole, although because of routing between questions and the low number of mandatory

questions, the number of responses for each question varied.

OA policies

In response to the question, 'Does your organization currently have a policy of encouraging or requiring grant-holders to make their research outputs open access?', 19 of the 54 respondents (35%) reported that they did. A further 19 responded, 'No – but one is likely to be introduced in the next 12 months', whilst 14 (26%) did not have a policy and reported that 'one is not likely to be introduced in the next 12 months' (Figure 1). Seventy per cent of respondents therefore either had a policy already in place or expected to introduce one in the next year.

The 19 respondents with a policy gave details of when it came into effect, with dates ranging from 2006 to 2013 (Figure 2). The position is, however, a fluid one. Several respondents stated their organizations were likely to review their current policy in the light of recent developments. Other organizations commented they were monitoring developments and considering their position.

46 respondents provided figures for their annual research spend (see below), mostly in the form of approximate figures for 2011–12. Comparing these with the responses to the question on OA policy, there was a strong positive relationship between large organizations (by research spend) and those with an OA policy. 68% of organizations reporting a research spend of over £1.5 million per year had a policy in place, compared with 22% below £1.5 million ($\chi^2 = 10.797$; degrees of freedom = 2; $P = 0.0045$). All Europe PMC members who responded had an OA policy (a condition of Europe PMC membership) compared with 17% of non-Europe PMC members.

Whilst the details of these policies differed between organizations, most of them shared two key features in common. Sixteen of the 19 policies specified that outputs should be made available in an open access form within six months of publication, and 15 specified they should be deposited in Europe PMC (or PubMed Central). The remainder did not specify any allowable embargo or deposition venue.

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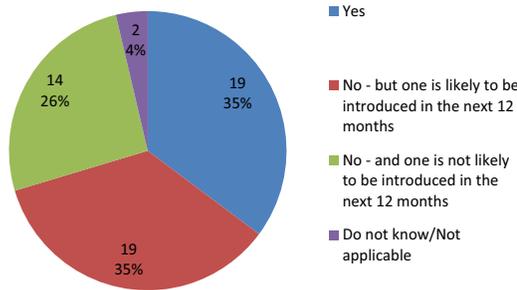


Figure 1. ‘Does your organization currently have a policy encouraging or requiring grant-holders to make their research outputs open access?’ (n = 54).

Compliance

Of the 19 respondents with OA policies who commented on the monitoring and measuring compliance of grant holders, eight (42%) stated they did measure compliance whilst nine (47%) did not (two did not know). Those that did measure compliance were able to choose from a variety of suggested ways in which they checked compliance or specify other approaches. The most popular of these (both used by five) were checking compliance of articles listed in PubMed and checking Europe PMC. However, only a small number of respondents were able to state specific levels of compliance, and in those cases mostly estimates were given with figures commonly between 20% and 40%. One organization with an established OA policy quoted figures as high as 65–70%, and another organization with the new policy reported full compliance but over a very short period.

Some respondents stated that that policy had only recently come into effect and it was therefore too early to measure compliance.

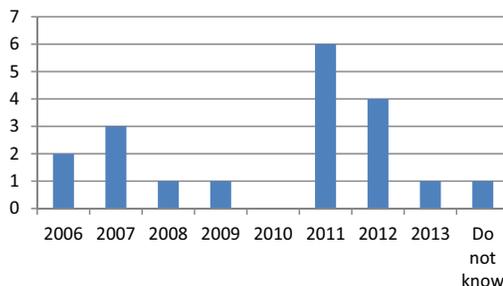


Figure 2. ‘When did your organization’s policy come into effect?’ (n = 19).

Other respondents stated that they had only recently begun to monitor compliance or were planning to do so in the near future. However, resources were reported to be a major constraint, with one respondent commenting:

‘Currently [the organization] does not have the in-house resource to measure compliance, but it is something we are keen and plan to do over the coming year, should resources allow it.’

Of the 19 respondents with an OA policy, 10 (53%) stated that their organization undertook ‘actions to improve compliance’ with their OA policy. A wide variety of different methods were used, mostly focused on awareness-raising and encouragement of authors. For example, eight respondents stated they wrote to authors to encourage them to comply. Other awareness-raising approaches mentioned included outlining the OA policy in grant application documents and reminding grant-holders in routine correspondence. However, fewer respondents favoured using sanctions, with only a small number of organizations stating they were willing to withhold funding in various ways from researchers or their organizations in order to encourage compliance. However, resources were again reported to be a concern:

‘We could, in principle, do any or all of the other actions listed [in the survey] to improve compliance. However we do not have the resources (research advice and administrative team time, and budget) which would be necessary to provide sup-

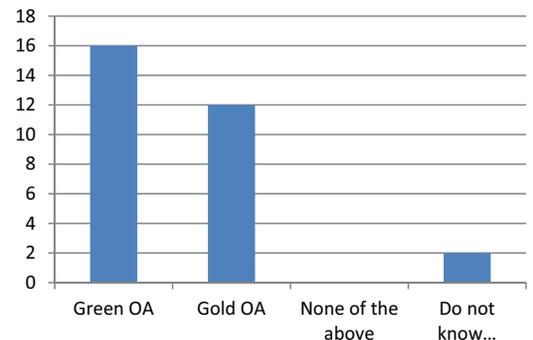


Figure 3. ‘Which of the following does your organization’s policy allow?’ (n = 19).

resources were reported to be a major constraint

port of this kind for all of the publications resulting from the research we fund.'

There is then considerable variation in whether and how charities are monitoring compliance with their OA policies and the extent to which they are taking action to improve compliance levels.

there is then considerable variation in whether and how charities are monitoring compliance with their OA policies

Green or gold OA?

Most of the OA policies of respondents allowed either 'green' or 'gold' OA. Of the 19 respondents replying to this question in the survey, 16 allowed green and 12 gold OA, with most allowing both (Figure 3). Five respondents stated they allowed green but not gold, whilst only one reported allowing gold but not green. Four stated a preference for gold and one for green, whilst seven had no stated preference. One respondent commented that allowing both made it easier for grant-holders to comply with their policy.

A number of different reasons were cited for preferring gold, including immediate OA availability of content, support for a working business model and deposition in Europe PMC:

'We prefer gold open access as it means the research is immediately available upon publication, and it also helps transition to and support a more transparent business model for publishers. However, allowing green access as an option provides more flexibility and maximizes the number of journals an author may choose to publish in whilst remaining compliant with our policy.'

However, even where gold was preferred, concern was expressed regarding resources:

'Gold would be our ideal and we want all grant holders to aspire to this. However, complexity of enforcing this and current uncertainty about how it would be funded makes it an impractical policy to enforce.'

'In order to promote only gold access, we would need to consider the cost implications, as we estimated it would cost [the organization] around £300k p.a. – a cost that is currently not budgeted.'

The resource issue was mentioned by some as a reason for preferring green:

'Green open access requires no costs for making the content open access ... it does not restrict the journal that the researcher publishes in but allows for the content to become open access and available to all. Researchers are free to follow the gold path should they choose to do so, but at their own cost.'

One organization stated that their thinking on green-gold balance may be reviewed in the light of recent UK developments (such as the RCUK policy) which gave greater prominence to Gold:

'The matter was last discussed by our [research committee] in 2007. At the time it was assumed that the green route to OA would be the most prevalent. Given the more recent prominence of gold, we may need to revisit our original policy.'

Publication licences

Only one organization said it specified particular licences for its grant-holders to use: either the Creative Commons Attribution licence (CC-BY) or Creative Commons Attribution Non-Commercial licence (CC-BY-NC). One organization said it was introducing a licence condition (CC-BY) in the near future where it had funded an APC. Another organization said it did not specify a particular licence but did require content to be reusable. However, the majority of respondents said they did not specify a particular licence, several commenting that there was little awareness of licensing issues in the organization, for example: 'We do not understand enough about this issue yet to introduce it into our policy at this stage.'

One respondent commented that they did not see it as the funder's responsibility:

'We provide no guidance on this matter, in our view this is a matter for the author and their employing institution.'

The level of engagement from charities on this issue is then currently low.

Publishing costs

On the issue of publishing costs, 30 (60%) of the 50 respondents who answered the question either opted for 'strongly agree' or 'tend to agree' with the statement of principle that

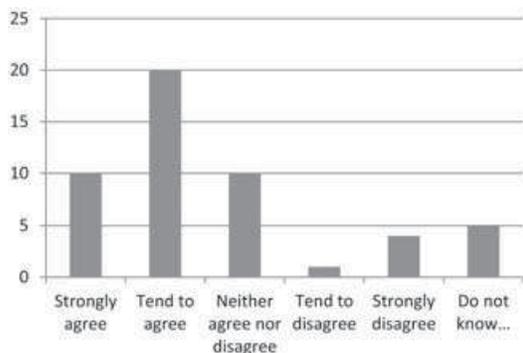


Figure 4. 'To what extent does your organization agree or disagree with the statement "the cost of publishing is a cost of research"'? (n = 50).

'the cost of publishing is a cost of research'. Five (10%) disagreed, either tending to disagree or strongly disagreeing (Figure 4).

One respondent summarized the most common view:

'The dissemination of research findings can reasonably be viewed as the final stage in a research project – and if there is a cost associated with this, as there often is, I would err on the side of considering this a legitimate research cost.'

A number of respondents commented on the importance of publishing research results: 'The expectation of funders and the duty of researchers that the research should be published. Not much point otherwise!'

However, some respondents made the point that there is an argument charities should not necessarily pay costs of OA publishing, defining them as indirect costs (overheads and infrastructure) rather than direct costs of the research itself. Several made this point in detail, for example:

'Peer-reviewed publications are a vital part of research and offer a filter through which quality research can be identified. Managing such a process understandably incurs a cost. Traditionally the costs of publishing were supported by library subscriptions funded by government. With the trend towards gold open access increased costs for government are likely to be offset by a reduction in library subscriptions. However, charity funders of research would

experience the increase in costs, with no offset. As a fundraising charity we see a distinction between the direct costs of research which we can support, in line with our charitable objectives, and the indirect costs which we do not. This distinction is already acknowledged by the government and we feel that the costs of publishing should fall into the latter category.'

On the specific question of whether OA publishing costs should be considered a direct or indirect cost of research, 17 of the 49 (34%) who answered the question agreed that APCs should be considered part of *indirect* costs, with only five (10%) disagreeing. However, there was considerable uncertainty, with 18 (37%) opting for, 'neither agree nor disagree' and nine (18%), 'Do not know/not applicable'. While some respondents (supporting the view expressed above) stated directly that, 'publication should be seen as an infrastructure cost', and therefore not covered by charity funders, this was not a universal view. One respondent summarized the contrary view: 'APC's are clearly a direct cost of doing research, research without publication is of limited value.'

Others expressed a more pragmatic view:

'I think an argument could be made either way on this one. It would be hard to see it as an indirect cost as it is due to a direct output of the research, however, smaller Charities will struggle to pay this.'

'... the fact is someone has to pay ...'

This is clearly an area of ongoing debate with significant practical implications. Successive UK governments have supported the Charity Research Support Fund providing money directly to universities to compensate for the 'lost' indirect costs arising from charity-funded grants. The question of whether the costs of OA publishing should be seen as part of this is obviously an important one with major financial consequences. The new RCUK policy of providing block grants to institutions to pay APCs, reversing their previous approach of allowing for payment through direct research grants, has perhaps served to heighten debate on this issue.

Funding APCs

Respondents were very nearly evenly split

some respondents made the point that there is an argument charities should not necessarily pay costs of OA publishing, defining them as indirect costs

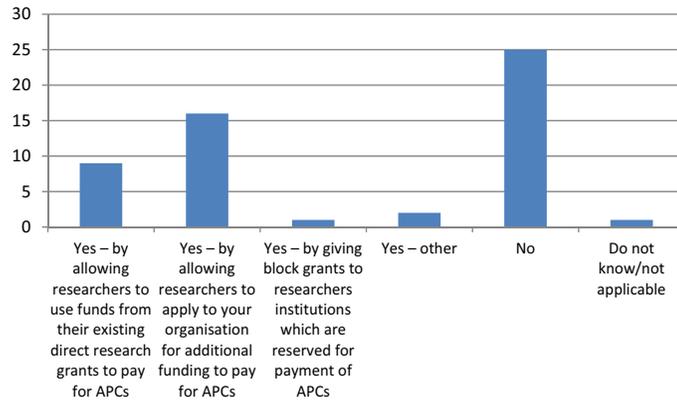


Figure 5. 'Does your organization provide funds to pay article-processing charges (APCs) to make journal articles open access?' (n = 49, allowing selection of more than one option under 'Yes').

on whether or not their organization funded APCs: 23 of the 49 respondents (47%) stated they did by choosing at least one of the affirmative options (Figure 5); 25 (51%) stated they did not fund APCs, and one did not know.

Of the 49 respondents, those organizations with an OA policy were more likely to fund APCs ($\chi^2 = 10.379$; degrees of freedom = 2; $P = 0.0056$). 14 of the 19 (74%) of the organizations with an OA policy stated they funded APCs, whereas only 9 of the 30 without a policy (30%) did. Also, large organizations were more likely than smaller organizations to fund APCs ($\chi^2 = 8.091$; degrees of freedom = 1; $P = 0.0044$). Of the 19 organizations with a research spend of more than £1.5 million per year, 14 (74%) funded APCs, whereas only 8 of the 27 (30%) with a research spend below £1.5 million did.

Of those funding APCs, 16 allowed researchers to apply for additional funding, 9 allowed use of direct research grants, and 1 provided researchers' institutions with block grants. Five organizations reported they funded APCs in more than one way. There was, however, significant variation in how well-established these arrangements were and how they were handled. Some respondents reported having established policies and processes allowing them to fund APCs routinely:

'Publication costs are an allowable cost for grants. We see no difference between these costs and requests for funds to attend con-

ferences to present posters or deliver an oral presentation.'

Others allowed one-off applications for support, although often operating on a small scale: 'There is a very limited fund and there has to be exceptional circumstances for the fund to be applied.'

Some took a pragmatic approach allowing the use of research underspends to fund APCs:

'We do not provide a separate fund for APCs, but researchers can utilize underspend should they so choose. We have no provision for papers arising from awards that have finished.'

Several respondents mentioned that they rationed expenditure, often at rates below most current APC levels:

'At the moment publication costs (of any type) are requested by some applicants (not all) but we limit the amount we fund to £1,000 per grant.'

'All grants are awarded a APC contribution on a sliding scale. Grants under £50k get £1k, £50-100k get £2k and over £100k get £3k.'

Resource constraints were the major reason cited for not funding APCs:

'We simply do not have the budget to do this at this time. We do agree with open access publishing but our budget is very small as it is and the priority at the present

resource
constraints
were the major
reason cited
for not funding
APCs

time has been to keep our research grants scheme going.'

Some organizations, however, reported that they had not yet been asked to fund APCs, with others reporting that they were at various stages of reviewing or changing their position:

'[O]ur board have just approved a new open access policy that will come into force in the autumn. We will be off-setting APCs for gold OA and will earmark a separate budget, outside the grants, to do this. Grant-holders will have to apply for APC funding on a case by case basis.'

The payment of APCs to grant holders is then an issue for which there is significant variation and change in the sector at present.

Cost data

With concerns about resourcing OA publishing and dissemination prominent in many comments of respondents, the issue of funding, and particularly the expected proportion of APCs of overall research spend, is particularly relevant. Respondents were asked to provide figures on their organization's overall annual research spend (ARS) and the number of papers published resulting from funded research in order to provide data for cost modelling. 26 organizations provided (in most cases, approximate) data in both areas (ARS and published outputs), 22 from 2011–12 and 4 from 2010–11. From these data it was possible to model the proportion of ARS which would be needed to fund APCs in the hypothetical event that all outputs were made OA via the charged-for gold route. Modelling was carried out using three possible APC levels:

- £2,072 (£1,727 plus VAT): the APC level used by RCUK in allocating block grants to UK higher education institutions;²⁰
- £1,800 (£1,500 plus VAT): based on Kiley's estimates;²¹
- £1,327 (including VAT): the mean average APC level actually paid by the University of Nottingham for non-BioMedCentral publications reported by Pinfield and Middleton.²²

Calculations are presented in Table 1. The data show significant variation, with percentages as low as 0.5% to as high as 11.2% for an

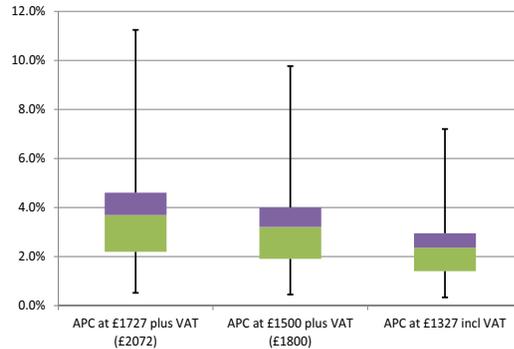


Figure 6. Article-processing charges as a percentage of overall annual research spend at different APC levels.

APC of £2,072. Percentage figures, however, do not seem to follow any pattern relating to ARS, although the highest figures do occur where ARS is £1 million or below (where small changes in numbers of published papers can have a significant impact on percentages).

These data are presented in a 'box plot' to illustrate both the distribution and clustering of data points (Figure 6). The 'whisker' lines extending from the boxes represent the full data range and the boxes themselves the middle 50% of the data points, with the top of each box being the 75th percentile and the bottom of each box the 25th percentile. These show a clustering of data points between 1.4% and 4.6% depending on the APC level. The median value for each series is possibly most significant with a data range such as this and is represented by the line in each box (50th percentile). The median values are:

- 3.7% of ARS for an APC of £2,072;
- 3.2% of ARS for an APC of £1,800;
- 2.4% of ARS for an APC of £1,327.

These data then provide a preliminary view of the proportion of annual research spend that would be required to support the charged-for gold OA route. The presentation of the data is, of course, provisional. Figures provided are estimates and more precise and consistent data gathering would be required to produce more definitive results. Also, additional factors need to be taken into account. One of these is the possibility of double counting as a result of joint funding of research.

A significant proportion of research funded by medical research charities is co-funded

it was possible to model the proportion of annual research spend which would be needed to fund APCs

Table 1. Article-processing charges as a percentage of overall annual research spend at different APC levels

2011–12 Annual research spend (£) ^a	2011–12 published articles ^a	APC at £1,727 plus VAT (£2,072) (%)	APC at £1,500 plus VAT (£1,800) (%)	APC at £1,327 incl VAT (%)
643,000,000	4,433	1.4	1.2	0.9
332,000,000	1,800	1.1	1.0	0.7
210,500,000 ^b	1,434 ^b	1.4	1.2	0.9
28,000,000	292	2.2	1.9	1.4
10,000,000	192	4.0	3.5	2.5
6,000,000	172	5.9	5.2	3.8
5,039,040	50–75	2.1–3.1	1.8–2.7	1.3–2.0
5,000,000	76	3.1	2.7	2.0
4,800,000 ^b	86 ^b	3.7	3.2	2.4
4,062,012	43	2.2	1.9	1.4
2,700,000	60	4.6	4.0	2.9
1,800,000	40	4.6	4.0	2.9
1,400,000	10	1.5	1.3	0.9
1,300,000	25	4.0	3.5	2.6
1,030,000	16	3.2	2.8	2.1
1,000,000	31	6.4	5.6	4.1
800,000 ^b	2 ^b	0.5	0.5	0.3
737,000	40	11.2	9.8	7.2
449,000 ^b	8 ^b	3.7	3.2	2.4
424,334	8	3.9	3.4	2.5
250,000	3	2.5	2.2	1.6
235,000	3	2.6	2.3	1.7
200,000	10	10.4	9.0	6.6
155,193	3	4.0	3.5	2.6
140,000	5	7.4	6.4	4.7
136,725	2	3.0	2.6	1.9

^aMost figures are estimates.

^b2010–11 data.

by more than one organization. Walport and Kiley, in their description of Wellcome policy, stated that ‘more than 80% of papers that acknowledged our support also acknowledge the support of one or more other funders’.¹³ Because of this it is possible that at least some APC payments could be shared between co-funders, thus reducing the overall percentage of ARS for each. In order to assess how significant this factor may be, an investigation was carried out focusing on research papers

housed in Europe PMC and citing funding from at least one of the eight original Europe PMC funders for whom detailed metadata are present in Europe PMC (Table 2). For these papers, co-funding with at least one of the other seven organizations was checked for the period 1 January 2012–31 December 2012.

A total of 17,760 papers were produced in 2012 which included acknowledgements to one of these eight funders, with 7,661 (43.1%) co-funded by at least one other of the eight.

Table 2. Co-funded research articles in Europe PubMed Central for 2012 by the eight founding members of Europe PMC

Funder	Total no. of papers	No. of co-funded papers	% of papers co-funded by at least one of the other seven funders
Arthritis Research UK	321	115	35.8
Biotechnology and Biological Sciences Research Council	3,131	1,004	32.1
British Heart Foundation	1,140	596	52.3
Cancer Research UK	1,616	688	42.6
Chief Scientific Officer	207	102	49.3
Department of Health	1,009	483	47.9
Medical Research Council	4,849	2,393	49.4
Welcome Trust	5,487	2,280	41.6
Total	17,760	7,661	43.1

The implications of this for APC payments are potentially significant. For example, if all of these papers were funded by just two funders and they shared the cost equally, the eight funders would expect to pay the full costs of 56.9% of papers they fund but half the cost of the remaining 43.1%. This means they would be paying three-quarters of what the cost would be if each funder paid the full cost for every paper they funded. This would lead to a significant reduction in APC payments for each funder and thus a reduction in the percentage of ARS required for APCs. This analysis indicates then that the issue of double counting is potentially serious. However, it remains unclear how this may impact on the wider range of funders and articles reported in this paper. Clearly, more work is required in this area.

Opportunities and challenges

Respondents were invited to identify major positive and negative impacts on them associated with recent OA developments. On the positive side, recent developments were reported to have raised the profile of OA, encouraging charities to develop and promote clear policy positions:

‘We are aware that this is something it is essential for us to have a policy on and are developing one.’

‘We were planning to implement an open access policy (and fund) regardless of exter-

nal developments. However, the fact that this is becoming more widely accepted as the direction of travel makes it easier to implement.’

Some respondents expressed enthusiastic support for OA and believed recent developments would help to further OA:

‘We are passionate about Open Access and approve of a discussion surrounding it, which in effect supports our pre-existing policies.’

‘Recent OA developments have been welcomed by [the organization], as it has raised the issue of OA with a wider group of people and will ultimately increase the number of research publications available to the public, and the number of organizations engaging positively with the issue.’

A number of organizations expressed optimistic views that OA was likely to improve access to the outputs of the research they funded:

‘Increased access to the results of our research which should hopefully increase its reach and impact.’

‘It makes [the organization’s] funded research available and more accessible.’

Other positive impacts mentioned included reducing the overall costs of dissemination of research outputs, encouraging greater transparency in research, allowing the charity to access publications it itself has funded, and

recent developments were reported to have raised the profile of OA

raising the profile of the charity itself and its work.

However, some organizations had not yet seen any impacts of recent OA developments but in some cases reported being better informed:

'We have not really addressed this matter in detail. It is to be discussed during 2013/14 financial year.'

'No impact as yet but increases our willingness to use the open access route.'

The major negative impacts raised related to resources and financial impacts. Some of these related to the specific issue of funding APCs:

'Supporting OA means funding APCs, which could be a significant cost and ultimately reduce the number of grants we can award.'

'Will increase our costs for publication, which must come from a fixed overall research budget.'

Other concerns about resourcing included increased administrative costs associated with supporting OA, monitoring compliance and communicating with researchers. In particular, a number of respondents expressed concerns about confusion and negativity within the research community:

'Potential confusion within the research community (one paper, 6 authors, multiple funders, multiple open access policies ...).'

'The reception of some of these developments by some parts of the research community has not always been positive. We are happy to have concerns be brought to light so that they can be discussed and addressed, but the benefits of OA can be lost in the detail of these discussions which is unfortunate as the benefits are so great.'

Concern was also expressed about increased costs in relation to the expectations of donors and other stakeholders:

'As a charitable research funder reliant on public donations, our aims are to fund the best quality research in our field and to provide real improvements to the lives of people with [particular medical] conditions. The current trend towards gold open access,

and the potential of increased cost of open access to the charity is a cause of concern. As a fundraising charity, we must operate in line with our charitable objectives, and meet donor's expectations that their contributions are spent directly on research; paying article processing charges (APCs) may not align with this expectation.'

Expertise and further assistance

Participants were asked whether their organization had 'the expertise and resources to advise researchers on open access issues'. Of the 47 answering this question, the majority (26 or 55%) believed they did not have the expertise and resources required, whereas only 16 (34%) believed they did. There was an observable correlation between large organizations and those stating they had sufficient expertise. However, because of the small sample size this could not be tested statistically. Nevertheless, as a number of free-text comments also mentioned the constraints felt by small organizations, the issue of organizational size may reasonably be judged to be a factor.

Given the expressed deficiencies in expertise and resources, 33 respondents made a wide range of suggestions regarding what further assistance could be given to charities, particularly by AMRC. 22 of these comments highlighted the need for more information and advice on OA issues. Respondents were keen to receive information on key issues and wanted opportunities to share best practice. Others specifically requested guidance and training, including recommendations on policy and implementation issues from AMRC. A number of comments also suggested possible co-ordination of OA policy development amongst charities to create greater evenness across the sector. To inform this, some respondents also suggested that more work be carried out on developing a clear evidence base about OA and its impact on medical research charities. In addition, it was suggested, a single point of information about publishers licensing policies would be useful, possibly involving the augmentation of existing SHERPA RoMEO services (as has already been done in the past for the Wellcome Trust and RCUK).²³ Some respondents went further and suggested possible co-ordinated action by charities in areas

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such as sharing administrative costs, including shared processes and systems, and negotiating with publishers over licensing terms. As well as publishers, it was suggested that co-ordinated work with other stakeholders, including other funders and universities, could encourage greater consistency.

Discussion

The research presented here contributes to a wider set of interlocking issues relating to OA and research policy. These include:

- policy v. practice for OA;
- green v. gold routes to OA;
- costs v. benefits of OA;
- direct v. indirect funding for OA;
- organizational v. sectoral action on OA;
- sectoral v. cross-sectoral action on OA.

On the first of these, it is clear that the development of more directive funder policies with regard to OA (and other major issues) is becoming more common in the medical research area. This represents a shift away from traditional custom and practice which tended to take a less interventionist position. Increasingly, funder organizations of all sorts wish to ensure and demonstrate value from their expenditure and therefore expect grant-holders to comply with certain conditions in areas such as disseminating research outputs. Funders can therefore be reasonably expected to monitor compliance with their policies (requiring researchers to report on their activities) and develop approaches to further incentivize compliance (in order to improve compliance levels). The extent to which funders can do so without imposing unnecessary burdens on researchers is, however, a moot point and one on which respondents reflected in their comments. It is an important area for ongoing consideration in policy development. Equally important are practical issues associated with the administration of OA, such as business process design for APC payments, arrangements for co-funding APCs and tracking activity. All of these require further work.

One specific area of policy development with regard to OA reflected in the responses of participants is the green v. gold debate. This debate has been heightened in the UK, and internationally, by the Finch Report and sub-

sequent RCUK policy development which signalled a preference for Gold. The biomedical discipline has tended to favour gold rather than green to date in any case,¹⁴ although most of the policies reported in this study allow either, permitting no more than a six-month embargo period. It is important to note, however, that OA journal publishing and repository development are not necessarily mutually exclusive OA models (despite the sometimes polarized debate). Combined with an adoption of charged-for gold OA, large-scale disciplinary repositories (e.g. PubMed Central and Europe PMC) have been developed. A number of models of OA are emerging in practice which involve a combination of journals and repositories supported by various business and funding models.²⁴ The increasingly successful OA scholarly communication system developed to support biomedical research is then not sustained merely by APCs: a significant level of ongoing investment by biomedical research funders also goes into the maintenance of the large-scale biomedical repositories. The precise configuration of systems and processes in this and other disciplines, and the impact they will have on sustainable scholarly communication practices in the long term remains to be seen.

As well as the OA route (green or gold), the level of openness is an important policy issue. The extent to which OA materials are fully reusable and can therefore be processed in various ways (e.g. text mined) may vary significantly according to different licences. However, the absence of consideration of licences from responses seems to indicate this has not yet impacted on the current thinking of many charities. It might be expected that this will become more important as thinking on open access, and its consequences for research, develops.

One significant part of the question relating to the preferred OA model is that of cost. The data presented here showing APC costs as a proportion of overall research spend can potentially inform ongoing discussion. The proportions given are somewhat higher than those that have been quoted by advocates of gold OA in the past. They of course need testing, and more (and more precise) data need to be assembled to add to the evidence base in the charity sector as well as others. One

it is important to note, however, that OA journal publishing and repository development are not necessarily mutually exclusive

key question is that of APC levels and where these are likely to 'settle' as the APC market matures. The extent to which the market will tend to inflate APC prices is still uncertain and the role of institutions in leveraging their market power to keep APCs low remains to be seen.²⁵

One other important consideration in relation to cost raised by this research is *who* pays. Although there is evidence that system-wide costs may be reduced by OA,²⁶ the distribution of costs and benefits in pure financial terms may not necessarily be evenly spread. There is concern amongst charities that they may experience additional costs without seeing commensurate savings elsewhere in their own budgets. Research institutions, on the other hand, may see an increase in costs to pay and administer APCs but in the long term are likely to see savings in periodicals subscription budgets and related administration. Similarly, government funding agencies may see an increase in funds allocated to APCs but are likely to see reductions in funding for infrastructure such as library budgets (notwithstanding transition costs). UK charities may experience rising costs but not see commensurate savings. In wider OA implementation discussions, therefore, the overall position of stakeholders such as charities needs to be taken into account in structuring funding and directing funding streams. At the same time, there also perhaps needs to be a clear articulation of the offsetting *benefits* of OA for the different stakeholders (as well as the costs). Whilst many of these may be difficult to quantify, they may nevertheless be significant, as some of the participants in this research indicated. More work is required in order to demonstrate benefits against potentially increasing costs.

One specific aspect of this debate is the question of direct v. indirect funding, an issue that was clearly considered to be important by respondents. In a sector which does not fund indirect costs, it may be easy to see the view that APCs should be defined as indirect costs as a 'get out'. However, the issue does, of course, relate to the question of principle of what is core to the mission of charities and therefore what charitable funding can legitimately support. The in-principle question of whether the costs of publication are part of

the costs of research itself remains important, and one around which there is considerable uncertainty. However, in practice, the direct v. indirect question may need to be addressed in a more nuanced way than a simple 'either-or' argument. In the multi-funder, collaborative research environment of UK biomedical research, where many stakeholders (funders, universities, researchers, health service providers) benefit from OA, alternative ways of determining how costs may be covered should perhaps be investigated.

The issue of direct v. indirect funding is one that needs to be addressed at a sectoral level by all medical research charities in liaison with government and others. This is an illustration of the importance of sector-wide action, where organizations such as the AMRC can provide a single voice for medical charities. The extent to which developments discussed in this paper can be taken forward through co-ordinated action is an important one for ongoing discussion. This will partly depend on the capacity of individual organizations (which vary significantly amongst AMRC members) and partly on the extent to which a consensual position can be found throughout the sector enabling co-ordinated action.

In some cases, co-ordination needs to occur at a higher level, across sectors. Some activity, e.g. around OA policy, would benefit from research funders across sectors co-ordinating activity in various ways, including, for example, policy development, and compliance monitoring. Also, establishing greater consistency between OA policies between funders and institutions as well as agreeing operational approaches to issues such as co-funding APCs are certainly required. Such activity could also usefully happen internationally as well as cross-sectorally.

Conclusions

This research makes clear that many medical research charities consider OA to be an important current policy issue. Amongst respondents, there was considerable stated support for the principles of OA and little stated opposition. OA is clearly increasingly becoming an accepted part of research communication. Some organizations already have OA policies and funding arrangements in

there is concern amongst charities that they may experience additional costs without seeing commensurate savings elsewhere in their own budgets

place and see OA as a way of furthering their mission. Other charities are currently undergoing changes. However, a large number (particularly, small organizations) are only now beginning to address the issues and are uncertain about how best to do so. Concerns were expressed about the resource implications, with organizations feeling OA will create new financial costs, especially around funding APCs. Provisional data presented here does indicate the proportion of APC expenditure of total research spend may be higher for at least some organizations than has previously been assumed. Concerns have also been raised in relation to administration costs and the requirement for new expertise in organizations to support OA.

However, it is clear that at present too little is known about the details of publishing activity, potential costs and other key issues. Currently, data in these areas is being recorded inconsistently across different organizations. There is a need to make data gathering more consistent and sharing of such data, and other information, more systematic in order to inform policy discussions and to enable tracking of developments. Where appropriate, organizations such as AMRC, and perhaps the individual larger charities, can co-ordinate and lead activities, to share best practice and provide targeted advice and support. There is also potential for co-ordinated action in the sector in order to create benefits for individual organizations as well as the sector as a whole. Cross-sectoral and international collaboration and co-ordination are also necessary to ensure that benefits are maximized for the research community in general. The challenge now is not just to deliver open access but to do so in an optimal way.

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there is a need to make data gathering more consistent and sharing of such data, and other information, more systematic

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