

ANNA E. BÜLOWThe National Archives
London, UK

anna.buelow@nationalarchives.gsi.gov.uk

AGNES W. BROKERHOF*Cultural Heritage Agency of The Netherlands (RCE)
Amsterdam, The Netherlands

a.brokerhof@cultureelerfgoed.nl

*Author for correspondence



THE QALY IN COLLECTION CARE – A COST EFFECTIVENESS APPROACH TO COLLECTION MANAGEMENT

Keywords: significance, accessibility, collection quality, risk assessment, cost-effectiveness, value, collection management, decision-making

ABSTRACT

This paper introduces the concept of ‘quality adjusted life years’ (QALYs), a model used to measure cost effectiveness in health care, and its potential to inform collection management decisions. It describes the basic theory behind the QALY, its adaptation to collection care and its application in two case studies. It demonstrates that a utilitarian approach looking at ‘collection quality’, which includes values, accessibility, development, use and life expectancy, can place risk management and decision-making in the larger context of collection management.

RÉSUMÉ

Cet article introduit le concept de QALY (années de vie sans invalidité), un modèle utilisé pour mesurer la rentabilité des soins de santé, et son utilité potentielle pour la prise de décisions dans la gestion des collections. Il décrit les principes théoriques fondamentaux qu’il recouvre, son adaptation à la gestion des collections et sa mise en pratique, à travers deux études de cas. Il montre qu’une approche utilitaire axée sur la « qualité de la collection », à savoir sa valeur, son accessibilité, son développement, son usage et son espérance de vie, permet d’intégrer la gestion des risques et la prise de décision dans le contexte plus large de la gestion des collections.

RESUMEN

Este artículo introduce el concepto de QALY (Años de Vida Ajustados por Calidad), un modelo utilizado para medir la eficacia de los costes en salud, y su potencial para aportar información a la hora de tomar decisiones relacionadas con la gestión de las colecciones. Describe la teoría sobre la que se basa AVAC,

INTRODUCTION

The growing interest in ‘collection risk management’ is shifting the focus of preservation from retrospective improvements, where losses have occurred, towards a prospective view of minimising loss. The risk management process involves assessing risks, identifying options for risk reduction, deciding on and implementing the best option. Best options are usually selected on the basis of reducing magnitude of risk or uncertainty with preference for the most effective option, where effectiveness is improved preservation. Yet with competing resource requirements, cost-effectiveness analysis should also be included in decision making. This situation is comparable to the allocation of health care resources especially in the UK and The Netherlands, where resources are limited, and as a result priorities must be established. Criteria that play a role in these choices are necessity of treatment, effectiveness of treatment, cost, and social righteousness. One way to express and compare the effectiveness of medical treatments in health care is using the unit of measure known as the ‘quality adjusted life year’ or QALY (Brouwer and Rutten 2006, Phillips 2009). One year lived in perfect health is equal to one QALY whereas death is equated to zero. A QALY takes into account both the quality of life and the quantity of life (life expectancy) generated through particular health care interventions.

Similarly, choices for resources to support collection care need to be well argued and, for risk reduction options to be sustainable, they should not drain on future resources. In order to apply the QALY approach to collection care issues, the ‘collection quality’ needs to be defined and assessed. Looking at collection management from an utilitarian perspective, ‘quality’ refers to the ability to use collections. This is derived on one hand from the values and significance of a collection for present and future generations, and on the other hand from their accessibility.¹ Quality on an utilitarian level can therefore be defined as ‘accessible value’.²

In order to quantify ‘collection quality’, criteria need to be defined for both significance and accessibility. A scale is also needed to assess them. ‘Life expectancy’ can be derived from risk assessments. Alternatively, one can set a time horizon and estimate how quality changes in that period. For example the time span of a policy period or one in which material changes are known to occur, such as 40 years for photographic material.

su adaptación al cuidado de las colecciones y su aplicación en dos estudios de caso. Demuestra que un acercamiento utilitarista para analizar la "calidad de las colecciones", que incluye los valores, la accesibilidad, el desarrollo, el uso y la esperanza de vida, puede situar la gestión de riesgos y la toma de decisiones en un contexto más amplio dentro de la gestión de las colecciones.

A quality curve shows how collection quality changes over time (Figure 1). Without interference, the quality curve will generally follow a sigmoid pattern. The surface area under the quality curve is the product of quality and life expectancy, and represents the number of QALYs. The quality curve will shift as a result of a particular conservation treatment or measure. For example, life expectancy can be increased, rate of decay can be slowed down, or quality can be improved. Consequently, the surface area under the curve will change. The increase in surface is a measure for the effectiveness of the treatment. This makes it possible to compare different treatments with each other or with the zero option (current situation or no treatment), and express their effectiveness in terms of added QALYs and subsequently their cost-effectiveness in cost per QALY or in incremental cost per QALY (ICER). The latter looks at the ratio of the change in cost of a treatment to the change in QALYs. Added QALYs at lower costs are always dominant, while added QALYs at higher costs require calculation of the ICER to determine the best option. Loss of QALYs at lower costs could be acceptable savings, yet at higher costs they are a waste and hence dominated by the current treatment. Thus cost-effectiveness can be taken into account in the overall decision-making process at a collection management level.

This paper describes the development of the adaptation of the QALY methodology to collection care and its application in two case studies at Museum Volkenkunde (National Museum of Ethnology, Leiden, The Netherlands) and The National Archives (London, UK). The approach described in this paper sketches the developments so far and is meant to provoke discussion rather than provide the final prescriptive method.

METHODOLOGY - EXPERIMENTAL

'Collection quality' is quantified on the basis of five dimensions: two sets of criteria for significance, so called 'primary' and 'comparative', from *Significance 2.0* (Russell and Winkworth 2009), and three sets of criteria for the main functions to enable access: find, retrieve and present, as described within the context of Resource Discovery Technology (in Information Management the ability for software to automatically determine what a resource is and what it contains) (Geser 2004).

Significance 2.0 assesses cultural significance by looking at four *primary* criteria that describe the core cultural values of a collection: informational, artistic/aesthetic, historical, and social/spiritual. At least one of these values is required for a collection to be regarded of cultural significance.³ These values can be enhanced by four *comparative* criteria which describe the collection's attributes: condition, rarity/representativeness, provenance, and interpretive capacity. These criteria can be analysed separately but are given an overall primary and comparative score. *Significance 2.0* has been shown to be valid in the context of archives (Anderson 2008), and is also in line with appraisal criteria used by The National Archives (Mercer 2004).

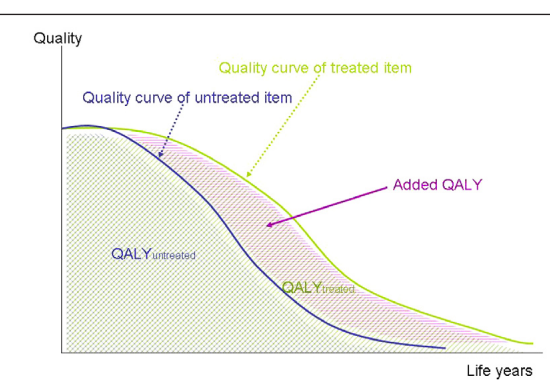


Figure 1

'Quality graph' showing QALYs as a product of collection quality and life expectancy for a situation without treatment (blue) and after treatment (green). The surface area under the graphs equals the number of QALYs. Added QALYs as a result of a treatment that slows down the rate of decay are indicated as the difference in area under the two curves (purple)

Resource Discovery Technology requires a finding tool, such as a catalogue or search engine, to enable a user to locate an item within an institution's collection. Furthermore, a retrieval tool is required, enabling staff to locate items within storage areas and deliver them fit for use, and lastly a presentation tool to proactively share items with a larger public. These dimensions, together with those for significance, are further described in Table 1.

Table 1

Definitions for dimensions and criteria to assess collection quality

Criteria	Low	Medium	High
Primary significance	Local Support collection Individual opinion	Regional Core collection Shared opinion	National Treasures General consensus
Comparative	Poor	Fair	Good
Find	Item can be found on collection level Catalogue use requires assistance Information overload	Item can be found on series or sub-collection level Catalogue use requires knowledge or skill Information load	Item can be found at item level Catalogue use possible without assistance Relevant information
Retrieve	Hardly meets user's or institution's demand (speed, context) Orderable item is within a collection (box) Limited fitness for use (slide but no projection) Content of original or surrogate hard to access (legibility, language)	Partially meets user's or institution's demand Orderable item is within a set (folder) Partly fit for use (alternative image view) Original or surrogate offer accessible content	Fully meets user's or institution's demand Orderable item only can be retrieved (file) Fit for use (projected image) Original or surrogate with accessible content and context
Present	Passive use look and see 1 level (*) Single user 'Come and get' access at institution	Active use zoom and discover 2 levels Limited number of users 'Restricted online' search and order online	Interactive use feed back and develop 3 levels Unlimited users 'All for free' free online access

(*) 1, 2 or 3 levels refer to presenting 1, 2 or 3 of the following levels of an item: container (physical item or digitally born; slide, file), content/concept (image, textual information), and context/function (bigger story).

Each of the five dimensions (i.e., two for significance and three for accessibility) is assessed against a benchmark or target as either low (L), medium (M), or high (H). Combinations of scores for these dimensions result in a number for 'collection quality' between 0 (no accessible value) and 1 (maximum accessible value). It should be noted that a score of 0 is not an absolute number suggesting that items are worthless. It merely indicates the 'threshold value' for items to be included into a collection. This approach is similar to that used in health care to determine quality of life (EuroQol 2009), yet where in health care thousands of people have been surveyed, the collection quality scores are based on a small number of respondents so far. The numbers for different combinations of the dimensions, as used in these experiments, are given in Table 2. Note that different types of institutions may weigh the dimensions differently and therefore have different matrices.

Table 2

Score matrix for collection quality based on assessment of significance and accessibility.

L=low; M= medium; H=high; 0=no value/no possibility to find item; X=score may be L, M or H

Primary	Comparative	Find	Retrieve	Present	Quality
0	X	X	X	X	0
X	X	0	X	X	0
L	L	L	X	X	0.01-0.05
L	L	M	X	X	0.05-0.08
L	L	H	M	H	0.08-0.10
M	L	L	X	X	0.10-0.15
M	L	M	X	X	0.15-0.20
M	L	H	X	X	0.20-0.30
M	M	M	M	M	0.25
M	M	M	H	H	0.30
M	M	H	X	X	0.30-0.40
H	M	M	M	M	0.40
H	M	M	H	H	0.40-0.50
H	M	H	M	M	0.60
H	H	M	H	H	0.60
H	H	H	M	M	0.60
H	H	H	M	H	0.70-0.80
H	H	H	H	H	0.80-1.00

APPLICATION TO CASE STUDIES

To experiment with and further develop the QALY model for cost-effectiveness analysis, it was applied in case studies at Museum Volkenkunde and The National Archives. Both institutions have carried out an extensive risk assessment in the recent past, could provide data on costs and faced pressing storage questions concerning photographic material with a relatively short life expectancy. These combined factors presented a more realistic parallel with human health care than for example paper and paintings.

Case study 1: the slide collection of the Mediatheek of Museum Volkenkunde, Leiden

This case study looked at competing requirements of a slide collection against a collection of black and white photographs (B/W). It involved 46,000 slides in the Mediatheek of Museum Volkenkunde, stored in nine slide cabinets at the non-climatised attic of the museum. About 25 percent of this collection is described and its significance assessed. The remaining 75 percent has not been assessed yet. A condition survey (von Waldthausen 2007) showed that the collection consists of the following: 20 percent black and white slides in a reasonable condition, 40 percent colour slides in a reasonable condition, and 40 percent discoloured slides (1.5 percent fully faded).

The slide collection consists of a number of sub-collections, based on photographer, region of the world, ethnographer, or their connection with collection or objects. They have high informational and historical

values for anthropological and ethnographic researchers. The slides form part of the documentation of the objects in the collection. They provide evidence of the objects in their original context and of their condition in the past. They also demonstrate the mindset of the Western ethnographers and collectors, and of the process of collecting. The slides can be found at collection level in the catalogue, but it requires assistance from the collection manager. The slides can be retrieved, the image projected, and information about the image can be provided by the collection manager. Only a limited number of slides and images are presented in exhibitions and publications.

The B/W prints are currently stored in boxes in 18°C/50% RH and 13°C/35% RH storage facilities. They have been designated as a historic collection at a national level due to their informational and artistic values. The prints are catalogued at item level and can be found without assistance. They were digitized and meta-dated for the ‘Memory of the Netherlands’ project (www.geheugenvannederland.nl), and the surrogates can be found easily. Originals and surrogates can be retrieved with content and context.

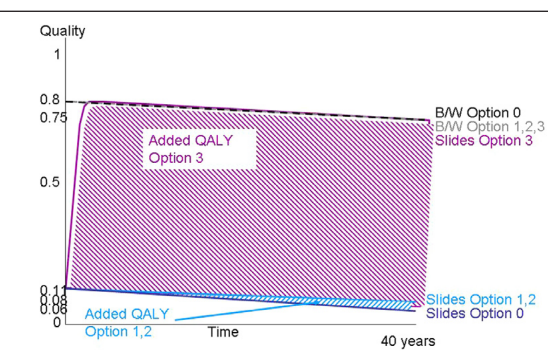


Figure 2
Quality graph for the three options for the
slide collection Museum Volkenkunde

Dilemma

The plan is to clear the attic, re-house all slides in 63 slide boxes and store those in a climatized storage room at 20°C/50% RH (option 0). The dilemma then is whether it is cost effective to continue with this plan given that the slides are expected to undergo a clearly visible discolouration in the next 40 years if stored under these conditions (von Waldthausen 2007), thus negatively affecting their quality. Alternatively, there might be a gain by making space in cool and cold storage areas which are currently occupied by, amongst others, the B/W print collection described above (Option 1). Moving the less susceptible B/W prints to 20°C/50% RH may influence their quality over the next decades very little, whereas lower temperature storage of the slides will slow down their rate of degradation. Even if the digital copies become obsolete, a new selection may be made for scanning and presenting on a then suitable distribution platform while the prints will remain available for presentation. In QALY terms: buying QALYs for the slides while hardly sacrificing QALYs for the B/W prints. Another option would be to leave the B/W prints where they are, and place the slides in their boxes in refrigerators that can be placed anywhere in the building (Option 2). A last option would be to digitise the slides, make them accessible on an interactive website and let users increase their significance by adding metadata, while the slides are stored in refrigerators and the B/W prints are stored at 20°C/50% RH (Option 3). The museum staff's assessment of collection quality of the slides and the B/W prints, currently and in 40 years, is summarised in Table 3. Figure 2 shows the quality graphs for the various options. The ageing process is simplified to linear decay.

Table 3

Quality of the collections considered in the two case studies for the various options. SP = primary criteria for significance; SC = comparative criteria for significance; AF = accessibility find; AR = accessibility retrieve; AP = accessibility present; Qf = quality of the fraction of the collection; F = fraction of collection; TCQ = total collection quality

		SP	SC	AF	AR	AP	Qf	F	TCQ
<i>Case study 1: Museum Volkenkunde slides</i>									
Currently	Known slides	M/H	M/H	L	M	L	0.40	0.25	0.11
	Unknown slides	L	L/M	L	M	L	0.04	0.75	
	B/W photos	M/H	H	H	H	M	0.8	1	0.8
Option 0	Known slide, in 40 years	M	M	L	L	L	0.20	0.25	0.06
	Unknown slides, in 40 years	L	L	L	M	L	0.02	0.75	
	B/W photos, in 40 years	M/H	H	H	H	L/M	0.75	1	0.75
Option 1&2	Known slide, in 40 years	M/H	M/H	L	L	L	0.30	0.25	0.08
	Unknown slides, in 40 years	L	L	L	L	L	0.01	0.75	
	B/W photos, in 40 years	M/H	H	H	H	L/M	0.75	1	0.75
Option 3	Known slide, in 40 years	M/H	M/H	H	H	H	0.75	0.25	0.75
	Unknown slides, in 40 years	M/H	M/H	H	H	H	0.75	0.75	
	B/W photos, in 40 years	M/H	H	H	H	L/M	0.75	1	0.75
<i>Case study 2: TNA DEFE 2</i>									
Currently	Files including photos	H	H	M	H	M	0.8	0.65	0.78
	Files excluding photos	H	M	M	H	M	0.75	0.35	
Option 0	Files incl. photos, in 40 y	H	M/H	M	H	M	0.75	0.65	0.75
	Files excl. photos, in 40 years	H	M	M	H	M	0.75	0.35	
Option 1	Files incl. photos to Q2, in 40 y	H	H	M	M	M	0.70	0.65	0.70
	Files excl. photos to Q2, in 40 y	H	M	M	M	M	0.70	0.35	
Option 2	Files incl. photos to Q2, in 40 y	H	H	M	M	M	0.70	0.65	0.72
	Files excl. photos in Q1, in 40 y	H	M	M	H	M	0.75	0.35	

Cost-effectiveness

A comparison of the effectiveness and costs for the options listed in Table 4 reveals that storing the slides and B/W prints in their current state requires almost €31,000 per year for 36.8 QALYs for the two collections together over the 40 year period, breaking down to a cost per QALY of €840 (option 0). Taking the B/W prints out of cold storage in favour of the slides (option 1) is dominant and makes a good saving. Option 2 is dominated by option 1, yet still a saving compared to option 0. Option 3 requires a substantial investment and is more expensive but provides so many additional QALYs that the ICER of €120 per year seems a worthwhile investment.

Case study 2: the DEFE 2 series at The National Archives, London

The case study at The National Archives (UK) concerns records of the Combined Operations Headquarters of the Ministry of Defence, archivally classed on series level as DEFE 2. It consists of war diaries and files relating to the planning and execution of raids against enemy troops to detract alertness from larger operations and boost public morale in Britain, covering the years 1937–1963. The total number of orderable pieces in this series is 2173, housed within 546 boxes, and occupying approximately 80 linear shelving meters. It is stored in the older part of the building (Q1)

Table 4

Cost effectiveness of the options for the two case studies. Total QALYs over a 40 year period. Total annual cost is one-off investments and annual costs averaged over 40 years. Incremental annual cost per QALY in relation to option 0

	QALYs	Added QALYs	One-off Invest € or £	Annual cost € or £/y	Total annual cost € or £/y	Annual cost per QALY € or £/y	Incremental annual cost per QALY € or £/y
Case study 1: Museum Volkenkunde slides							
0 B/W cold room	36.8	0	700	30850	30900	840	-
1 slides cold room	37.2	0.4	2000	26000	26050	700	dominant
2 slides in fridges	37.2	0.4	8700	30500	30700	825	dominant
3 digitise slides	63.8	27	150000	30400	34150	535	120
Case study 2: TNA DEFE 2							
0 all files in Q1	30.65	0	0	3700	3700	120	-
1 all files cool	28.00	- 2.65	300	5600	5600	200	dominated
2 photos cool	28.70	- 1.95	3100	4900	5000	174	dominated

at 18°C/50% RH. Spot checks indicate that approximately 65 percent of all boxes may contain photographs. Those seen during the checks were B/W, with some showing discolouration and poor condition.

Discussions with The National Archives' staff revealed that within the archival context the files derive significance mainly from their information and historic value. The photographs add visual information to the files. Condition and provenance only become an issue when the informational value is affected. The significance of the series, irrespective of the presence of photographs, was assessed as high.

DEFE 2 is fully catalogued; each operation is listed under its respective code name. It is therefore possible to find individual files within the catalogue, provided the code name of the operation is known. It is a popular series and is stored close to the reading rooms to enable speedy delivery to the user. DEFE 2 is not available online and there are currently no plans to digitise this series.

Dilemma

A risk assessment has shown that the most likely loss of value of the files is expected to be caused by frequent and poor handling and inappropriate environmental conditions (Bülow 2009). At The National Archives photographs are considered vulnerable materials which qualifies them for storage at 14°C/30% RH in the new part of the building (Q2). The dilemma is whether to maintain the current situation (option 0), store all files cool (option 1) or select the photograph containing files only for cool storage (option 2). If left at Q1 it is expected that in the next 40 years the quality of the files will decrease slightly as a result of deterioration of the photographs. Storing the whole series at Q2 would increase life expectancy of the photographs yet impair on the accessibility as the files need to condition before delivery to the much warmer reading rooms. Altogether, quality would initially decrease because of lower accessibility,

yet remain at the same level over the next 40 years. As a compromise, a full survey could identify the files containing photographs, and only these would be stored at cool conditions, limiting accessibility of only a part of the series. The assessment of collection quality of the DEFE 2 files, currently and in 40 years, is summarised in Table 3. Figure 3 shows the quality graphs for the various options.

Cost-effectiveness

Table 4 reveals that options 1 and 2 result in a reduction of effectiveness at increased cost. They are dominated by option 0 and are a waste of money compared to the current situation. Annual costs per QALY for leaving DEFE 2 in Q1 (option 0) are £120, which would almost double to £200 if all DEFE 2s were to be moved to Q2 (option 1). The survey costs, together with only an estimated 35 percent of the series to remain in Q1, means that option 2 would still cost £174 per year per QALY. At the same time, moving these documents from Q1 to Q2, away from the vicinity of the reading rooms and into cooler conditions to slow down degradation, has little effect on significance within the next 40 years, but decreases accessibility resulting in a net decrease of quality. In effect, The National Archives would get less quality at higher costs compared to option 0.

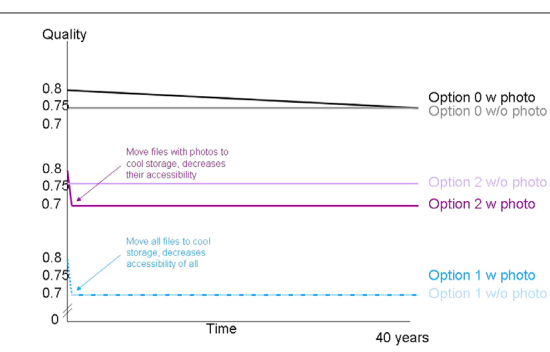


Figure 3
Quality graph for the two options for DEFE 2
at The National Archives

CONCLUSIONS

The QALY approach is one way to look at the cost-effectiveness of different options to reduce risks. Its application in two case studies shows that it has the potential to become a very useful tool to inform decision-making. It can help decide on storage options by indicating how re-arranging collections may lead to cost savings (Museum Volkenkunde). It can be used to analyse whether better storage conditions are an improvement compared to a current situation by weighing life expectancy against accessibility (The National Archives). It may also help to decide whether and to what extent investments will be cost-effective (Museum Volkenkunde).

Analysis of cost-effectiveness to underpin collection risk management increases awareness of working processes even further. The QALY takes an utilitarian approach to collection management and looks at managing collection quality. Whereas methods for cultural property risk assessment are applied within the context of preservation and consider values and life expectancy, the QALY is applicable within the larger context of collection management, including accessibility, development and use of collections.

Obviously, as popularity and significance of collections change over time, so does the requirement to keep them accessible. Significance, risks, accessibility and collection quality need to be re-assessed on a regular basis. Also, looking at the longer term, options that enhance life expectancy rather than current accessibility may be favourable.

ACKNOWLEDGEMENTS

The authors would like to thank the Farideh Fekrsanati, Graeme Scott, Monique Koek and their colleagues at Museum Volkenkunde, Leiden (NL); colleagues from Archives and Records Knowledge, Information Management and Practice, Document Services, Archives Sector Development, and Collection Care at The National Archives, UK for their patience and willingness to participate in this experiment; Hanneke van der Beek (ICN) for sharing her expertise in accessibility matters; Professor Frans Rutten (Erasmus University Rotterdam) for QALY guidance.

NOTES

- ¹ Accessibility can be provided to various levels or layers of the objects: the container (physical object), content and concept, and context. Accessibility can be achieved through the real, original (analogue or digitally born) objects and information, through virtual or digital surrogates and through augmented realities and virtualities.
- ² This is in line with the concepts behind the valuation model that was developed to assess effectiveness of expected outcomes of paper conservation research (Porck et al. 2006). This model was field tested in the Metamorfoze sponsored project ‘To box or not to box?’ at the Royal Library, The Hague (Netherlands), where it was compared with the first version of the QALY model (Bülow 2010).
- ³ The approach taken in this paper only looks at cultural significance and does not consider user, economic, and market values.

REFERENCES

- ANDERSON, K. 2008. The archives industry perspective on *Significance* as a collections management tool. *Significance 2.0 Workshop*, 2 July 2008, Collections Council of Australia. <http://www.collectionscouncil.com.au/articles.aspx?articleType=ArticleView&articleId=79/> (accessed 28 October 2010).
- BROUWER, W.B.F., and F.F.H. RUTTEN. 2006. Afbakening van het basispakket. De rol van het doelmatigheidscriterium. In *Zicht op zinnige en duurzame zorg*, Raad voor de Volksgezondheid en Zorg, Den Haag, 35–88.
- BÜLOW, A.E. 2009. Risk management as a strategic driver for a large archive. *Collections* 5(1): 61–72.
- BÜLOW, A.E. 2010. To box or not to box, that’s the question.... Internal report, Royal Library, The Hague, Metamorfoze project Nr. 2009-24.
- EUROQOL GROUP. 2009. EQ-5D – A standardised instrument for use as a measure of health outcome. <http://www.euroqol.org/> (accessed 27 January 2010).
- GESER, G. 2004. Resource discovery – position paper: putting the users first. In *DigiCULT. Resource Discovery Technologies for the Heritage Sector*, Thematic Issue 6, 7–12.
- MERCER, H. 2004. *Appraisal Policy*. The National Archives, London. http://www.nationalarchives.gov.uk/documents/appraisal_policy.pdf (accessed 8 November 2010).
- PHILLIPS, C. 2009. *What is a QALY?*. Hayward Medical Communications. www.whatisseries.co.uk. <http://www.medicine.ox.ac.uk/bandolier/painres/download/whatis/QALY.pdf> (accessed 6 November 2010).
- PORCK, H.J., F.J. LIGTERINK, G. DE BRUIN, and S. SCHOLTEN. 2006. Valuation model for paper conservation research: a new approach to setting research priorities. In

Preservation management for libraries, archives and museums, 83–96. London: Facet Publishing.

RUSSELL, R., and K. WINKWORTH. 2009. *Significance 2.0 – a guide to assessing the significance of collections*. Collections Council of Australia, Canberra. <http://www.environment.gov.au/heritage/publications/significance2-0/index.html> (accessed 8 November 2010).

VON WALDTHAUSEN, C. 2007. *Rijksmuseum voor Volkenkunde te Leiden Mediatheek Conserveringsplan*. Internal report, National Museum of Ethnology, Leiden, April 2007.