Using contingent valuation to evaluate the return on investment of a health library's out-of-hours access service

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Abstract

The purpose of this study was to calculate the return on investment (ROI) for Wexham Park Hospital library's out-of-hours access service, using the contingent valuation (CV) method. The primary objective was to develop and implement a CV survey to elicit library users' willingness-to-pay (WTP) for out-of-hours access to the library for one year, and secondary objectives of the study were: to use the aggregated WTP value as part of a cost-benefit analysis and ROI calculation; and to evaluate the reliability and validity of the CV method in the context of NHS library services.

A literature review was carried out, followed by a series of semi-structured stakeholder interviews to provide contextual information for the ROI calculation. An online CV survey was designed and distributed to 305 library users who had recently borrowed an access card. The survey used the payment card method to elicit WTP.

The CV survey response rate was 15.49%, and the sample mean WTP value was £5.64 per person, with a 95% confidence interval of £3.47 to £7.99. Regression analysis was carried out on the data to test for validity, but while some coefficients suggest that relationships might exist between some variables and WTP, such as pay band, they were not statistically significant at $p<0.05$ and the null hypothesis that there was no correlation could not be rejected.

Nevertheless, an aggregated WTP amount was calculated for the year, and used to establish an overall ROI of 4.75 % for the out-of-hours service over the three-year period since implementation.

The study concludes that the CV method is a complex but viable technique for evaluating NHS libraries and that ROI has a key role in the overall evaluation framework for libraries, alongside impact on national targets, patient care and educational outcomes.

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Other sources are acknowledged (e.g. by footnotes giving explicit references).
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Abbreviations

ALIA	Australian Library and Information Association
BBK	University of London, Birkbeck
BPS	British Psychological Society
BSA	British Sociological Association
CBA	Cost-Benefit Analysis
CBR	Cost-Benefit Ratio
CILIP	Chartered Institute of Library and Information Professionals
CV	Contingent Valuation
DBDC	Double Bounded Dichotomous Choice
DIS	Aberystwyth University, Department of Information Studies,
GMC	General Medical Council
HEE	Health Education England
HRA	Health Research Authority
HWPH	Heatherwood and Wexham Park Hospitals NHS Foundation Trust
LMS	Library Management System
NOAA	National Oceanic and Atmospheric Administration
NHS	National Health Service
NNLM	National Network of Libraries of Medicine
R&D	Research and Development
REMI	Regional Economic Modeling Inc.
ROI	Return on Investment
UIUC	University of Illinois, Urbana-Champaign
WPH	Wexham Park Hospital
WTA	Willingness-to-Accept
WTP	Willingness-to-Pay

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Chapter 1: Introduction

The purpose of this study is to calculate the Return on Investment (ROI) of a National Health Service (NHS) library's out-of-hours access service at Wexham Park Hospital in Slough, using the contingent valuation (CV) method for estimating the benefits of a non-profit service as a monetary value. Library ROI has been the subject of wide research in public, academic and national library sectors, but has only recently been explored in the context of health libraries. More research into ROI is planned in NHS libraries in England, and this study is therefore intended to provide an early insight into some of the issues and methodologies surrounding library service ROI.

1.1 Background

In 2015 Health Education England published *Knowledge for Healthcare* (Health Education England [HEE], 2015), a five-year development framework for NHS libraries in England. Within the framework, ROI was identified as an area for further research in order to optimise investment and demonstrate value, and was therefore deemed an appropriate and timely topic for this study.

The results of the literature review indicate that a wide range of studies into library ROI have been carried out over the last 10-15 years, especially in the academic and public library sectors in the US. Kaufman and Walter, for example, discuss an important University of Illinois ROI study (2008), which used grant income as the basis for calculating ROI. More common methods of estimating economic value are the *time saved* and *cost avoidance* approaches, used frequently in public library and other sectors; Florida public libraries, for example, used cost avoidance as the basis for calculating ROI (Griffiths, King, & Lynch, 2004), while in Australia, a study of special libraries used both approaches (Australian Library and Information Association [ALIA], 2014).

In 2004, the British Library also used a variety of approaches when measuring overall economic impact (Pung, Clarke, & Patten, 2004); in particular, its use of the CV method has proved influential, and subsequent library evaluation studies employing the CV method have been published , for example Hajek and Stejskal (2014), Chung (2008) and Hider (2008).

Contingent valuation is a *stated preference* technique drawn from economic theory and survey research methodology to elicit directly from consumers the values they place on public goods and services. It uses a survey describing a hypothetical choice within a hypothetical market to elicit estimates of willingness-to-pay (WTP) for, or willingness-to-accept (WTA), a particular outcome. CV studies elicit WTP or WTA via direct questions such as "What is the maximum amount you would be prepared to pay every year to receive good X?"

It has been widely used in environmental studies (Arrow et al., 1993), transport studies (Pearce & Ozdemiroglu, 2002), and health studies covering a range of areas such as rheumatoid arthritis treatment (Ozdemir, Johnson, & Hauber, 2009) and cervical cancer screening (Philips, Whynes, & Avis, 2006). As a method, it is not without controversy, since it is susceptible to a range of potential biases, such as hypothetical bias, strategic bias and anchoring bias. Nevertheless, there are a range of techniques for reducing the effects of bias (such as *dissonance minimising* and *cheap talk*), and it has now been used in thousands of studies (Carson, 2012, p. 28). Given the lack of CV studies in the context of health libraries, its use in this study will provide an interesting addition to the literature.

1.2 Scope

For the purpose of this study, it was decided that the ROI calculation would focus on one particular aspect of the library service at Wexham Park Hospital (WPH) rather than the library as a whole, due to time and resource constraints. The out-of-hours access service in the library was introduced in 2013 and provides a self-contained instance of a service suitable for evaluation.

WPH is part of an acute hospital Trust providing services to a wide and diverse population in Berkshire, with approximately 3,200 staff (Heatherwood and Wexham Park Hospitals NHS Foundation Trust [HWPH], 2014). The library service is based at Wexham Park Hospital in Slough; during the period 2014-15 the library employed 4.47 whole time equivalent (WTE) staff, with approximately 2,500 registered members and a stock of around 5,500 books. Since its implementation in 2013, the number of out-of-hours accesses has increased from just over 1,000 to nearly 4,000 per year (Brown, 2015). Currently around 300 library members have an out-of-hours access card on loan.

The study takes a mixed methods approach, collecting qualitative data via stakeholder interviews, and quantitative data via a CV survey. The interview data will be subjected to thematic analysis, while the CV survey will provide an aggregated monetary value for the benefits of the out-of-hours access service which can be used in the ROI calculation. The CV method has not been previously used in the context of NHS libraries, so the method will be examined for its applicability to other NHS library services. The CV survey findings will also be subjected to regression analysis to test validity.

1.3 Aim and Objectives

The aim of this study is therefore to calculate the Return on Investment for the out-of-hours access service at WPH library, using the CV method.

The primary objective is to develop and implement a CV survey which will elicit library users' willingness-to-pay (WTP) for out-of-hours access to the library.

Secondary objectives will be:

- to use the aggregated WTP value as part of a cost-benefit analysis and ROI calculation
- to evaluate the validity of the CV method in the context of NHS library services

1.4 Structure

The dissertation begins with the findings of the literature review (chapter 2), which played a key role in developing the research aims and objectives. Following on from this, the methodology chapter discusses the approaches to data collection and analysis, particularly the CV method, which is a complex and controversial technique. Chapter 4 provides the results of the interviews and CV survey, including thematic, descriptive and regression analyses, culminating in the ROI calculation itself. The implications and limitations of the findings are then discussed in chapter 5, while chapter 6 presents the main conclusions.

Chapter 2: Literature Review

In *Knowledge for Healthcare*, the new development framework for NHS library and knowledge services in England published in 2015, HEE states that "we will commission a study of return on investment in healthcare library and knowledge services for the NHS in England" (2015, p. 45). The rationale for this strategy comes from research undertaken in other countries which appears to correlate investment in library services with cost savings, and the lack of research in the NHS in England provided the starting point for this study. It is anticipated that this will cover some of the early groundwork for the HEE-commissioned study, examining the many issues surrounding ROI and allowing some insights into the key methodologies used in previous research.

The first step was therefore to carry out a literature review into library ROI, and searches were conducted across a range of databases using combinations of keywords and phrases related to ROI. As the review progressed, additional terms such as "value" and "cost benefit analysis" were used, before narrowing the focus to "contingent valuation":

Source	Keywords/Phrases	Results
MEDLINE, EMBASE, CINAHL, HMIC (Health Management Information Consortium), HEALTH BUSINESS ELITE	("return on investment" OR "roi" OR (return ADJ3 investment)) AND (library* OR "information service*")	85
LISTA (Library, Information Science & Technology Abstracts)	("cost benefit analysis" OR cba OR value OR "return on investment" OR "roi" OR (return ADJ3 investment)) AND (library* OR "information service*")	47
LISA (Library and Information Science Abstracts)	("cost benefit analysis" OR cba OR value OR "return on investment" OR "roi") AND (library* OR "information service*")	28
Health Information & Libraries Journal	"return on investment" OR roi OR value	7
MEDLINE, HMIC, HEALTH BUSINESS ELITE	"contingent valuation"	578

Table 1: Literature Search Strategy and Sources

The review itself is subdivided into two sections: firstly ROI is examined in the context of libraries; then contingent valuation is considered, introducing some of the method's key concepts and applications ahead of further discussion in chapter 3.

2.1 Return on Investment (ROI)

2.1.1 What is ROI?

ROI "…is how much you get back for what you put into something" (Lown & Davis, 2009, para 4) or more specifically "…a figure that tells how high the return is on each dollar invested" (Aabø, 2009, p. 312-313). Many authors (such as Kelly, Hamasu, & Jones, 2012; Pan, Wiersma, Williams, & Fong, 2013) make a clear distinction between a *cost-benefit analysis* (CBA) or a *cost-benefit ratio* (CBR) and ROI, where ROI is expressed as a percentage and calculated using the following formula:

$$\text{ROI} = \frac{(\text{Gain from investment} - \text{Cost of investment})}{\text{Cost of investment}} \times 100\%$$

And CBR is expressed as a ratio:

$$\text{CBR} = \frac{\text{Gain from investment}}{\text{Cost of investment}}$$

However it is fairly common to see ROI and CBR used more or less interchangeably; ROI for Southwestern Ohio's public libraries, for example, is presented in the form of the ratio 1 : 2.56 (Levin, Driscoll & Fleeter, 2006), while some libraries summarise their ROI/CBR figure in a more immediately understandable way, such "$6.54 for every $1 invested" (Griffiths et al., 2004, p. 3).

ROI may be considered a type of *derived value* (Tenopir, 2012, p. 6), and its relationship with other types of library value can be seen in table 2, a useful conceptual framework for evaluating library services (adapted from King & Boyce, 2003, cited in Matthews, 2007, p. 23):

Measurement Perspectives	Specific Metrics	Derived Metrics
Library	Inputs (Resources) Outputs (Products/Services)	Performance Effectiveness Cost-effectiveness Cost-benefit/ROI
User (actual and potential)	Usage (Use and Non-use)	Cost-benefit/ROI Impact
Organisation	Outcomes (Consequences of Information)	Impact
Community Served	Domain (Environmental Characteristics)	Impact

Table 2: Conceptual Framework for Library Metrics

The reasons for conducting an ROI study are broadly similar for libraries across sectors. In a meta-analysis of library ROI studies, Aabø (2009) begins by citing economic pressure and the growing need for accountability as the chief reasons why the field of library ROI has grown since the 1990s. Overwhelmingly, the need for libraries to justify their existence has been driven by finances (Huwe, 2011) and "tough economic times" (Balas, 2011, p. 31); according to Hendricks and Wooler, "being good at what you do and at the services you provide is no longer good enough" (2006, p. 14) and there has been growing recognition that librarians need to demonstrate value in alignment with organisational objectives, or "what the organization's leaders look for in judging value" (Strouse, 2003, p. 16). Some authors also cite the growth of the internet as a motivating factor, raising questions about the role of the library in relation to new technologies (Ard, 2012; Markless & Streatfield, 2013; Stielow, 2011).

But there are concerns that the ROI approach may result in a too narrow, financially-focused "bottom line" view of libraries (Markless & Streatfield, 2013, p. 14; Saracevic & Kantor, 1997, p. 530). Even if this can be mitigated, the use of ROI itself is open to question, due to a "lack of consistency in methodologies and applications" (Aabø, 2009, p. 312). In particular, Cullen notes a lack of consistency in definitions and data collection techniques, resulting in ROI calculations that are "considered flawed for use as anything more than in-house measures" (2003, p. 196), while Tenopir, King, Mays, Wu and Baer note that in a study of 8

university libraries in 8 countries, ROI (or rather, CBR) ranged from 1 : 0.64 to 1 : 15.54, concluding that "no one formula can be universally applied without adjustments" (2010, p. 184).

Even in the business sector, ROI is seen as susceptible to error through the under-reporting or ignorance of true costs (Dukart, 2007, p. 48). Coyle goes further by claiming that some economists "consider the ROI to be an overly vague measure, and one that can be easily manipulated to show whatever outcome one wishes to put forth" (2006, p. 537); James G. Neal, perhaps the harshest critic of the use of ROI in the academic library sector, talks of the "insanity of ROI" (2011, p.424), and describes much research as "inappropriate, unsophisticated and exploitable … a miscalculated, defensive and risky strategy" (Neal, 2011, p.424).

Underlying many of these concerns is the question of credibility. ROI results need to be defensible to the stakeholders and organisations to which they are communicated, and this demands a conservative approach in all aspects of ROI research (Strouse, 2003). In their comprehensive operating standards for an ROI methodology, aimed across all sectors but primarily conceived for businesses and project management, Phillips and Phillips make the point that only the most credible sources and conservative alternatives should be used, extreme data items should be avoided, and all costs should be fully loaded (Phillips & Phillips, 2007, p. 30). In addition, they cite the number one reason for failed projects as a "lack of alignment with the business" (2007, p. 16); in fact, strategic alignment is seen as a crucial step in developing performance measures generally, but this is particularly so in the case of ROI (Hendriks & Wooler, 2006; Luther, 2008; Murray, 2013).

Despite its challenges, therefore, if it is calculated using consistent and credible methods in a way that is aligned to the strategic objectives of the organisation within which the library operates, ROI can still be an important technique for communicating library value. Lown and Davis see ROI as "part of a suite of tools" (2009, para 36) and a multiple methods approach, of which ROI is a part, is advocated by many authors (for example Matthews, 2011; Pan et al., 2013; Tenopir, 2012, 2013).

2.1.2 Library ROI Studies

The meta-analysis of library ROI studies conducted by Aabø (2009) identified 38 studies for inclusion, and tentatively established that the mean ROI/CBR was 1 : 4.9. The studies all took

place between 1995 and 2008, with the vast majority in the US, and over 30 studies coming from public library services; Aabø concluded that there was a need for a "substantial increase" in valuation studies from other sectors (2009, p. 322), and while there have certainly been more studies published on the ROI of academic, national and special libraries since then, the public library sector remains the most well-represented and active in the literature.

Public Libraries

The US-based public library studies have tended to look at ROI in terms of public tax dollars invested and savings made by users not having to pay for similar goods and services elsewhere (i.e. *cost avoidance*); the ROI has consistently been high, somewhere between $2 and $10 for every $1 invested (Lown & Davis, 2009, para 7). One of the key works often cited is the Florida public libraries' ROI study (Griffiths et al., 2004); taxpayer ROI was calculated as $6.54 for every $1 invested, based on household telephone interviews and in-library surveys, and using a combination of cost avoidance and *time saved* methods. The study also used an input-output econometric model called REMI (Regional Economic Modeling Inc.) to look at the wider economic impact on wages and jobs, and concluded that "if funding for public libraries was reallocated across Florida's government sectors, the state economy would result in a net decline of $5.6 billion in wages and 68,700 in jobs" (Griffiths et al., 2004, p. ii).

Other notable US public library ROI studies include the South Carolina study in 2005, which found ROI to be 1 : 4.48, based on the libraries' perceived value in terms of general, business, personal and job-seeking use (Barron, Williams, Bajjaly, Arns, & Wilson, 2005; Missingham, 2005), and a 1999 St Louis study, which used consumer surplus and CV methods to calculate an ROI of 446%, or $4.46 for every $1 invested (Holt, Elliott, & Dussold, 1996; Holt, Elliott, & Moore, 1999).

CV has become one of the most common methods used by public libraries in ROI evaluations across the world; examples include a study in South Korea producing a CBR of 1 : 3.66 (Ko, Shim, Pyo, Chang, & Chung, 2012), one in Australia, with a CBR of 1 : 1.33 (Hider, 2008), and one in Norway resulting in a CBR of 1 : 4 (Aabø, 2005).

In the UK, meanwhile, CV and consumer surplus methods were used in an economic valuation of Bolton public libraries, demonstrating a CBR of 1 : 1.6 (Jura Consultants, 2005),

and in an Arts Council England study commissioned in 2014, the CV approach was used to establish that users' average willingness-to-pay (WTP) for library services via additional council tax was £19.51 per year (£10.31 for non-users) (Fujiwara, Lawton, & Mourato, 2015).

Academic Libraries

From the mid- to late-2000s, as US academic libraries started focusing more attention on efforts to calculate value in terms of ROI, it became clear that simply translating the measures used by public libraries to academic libraries would not work because of differences in outcomes, impact and overall context (Kaufman & Watstein, 2008); for example, time saved by students cannot be converted to salary cost-savings. New approaches and models were needed, and in 2007 a project team at the University of Illinois, Urbana-Champaign (UIUC) adopted a revenue approach previously developed by Strouse for corporate libraries (Strouse, 2007). The resulting study used *grant income* generated through the use of library materials, rather than time saved or cost avoidance, to calculate ROI, with the finding that $4.38 had been generated for every $1 invested in 2006 (Luther, 2008).

The UIUC approach, often called "ground-breaking" (for example Sidorko, 2010, p.647), has proved to be influential and subsequently adopted and adapted elsewhere; in Germany, for example, the Berlin School of Library and Information Studies and the University Library at Humboldt University decided to test and use the UIUC methodology in their own ROI study (Grzeschik, 2010). Although some simplification and amendments were required due to differences in scale and issues with the sensitivity of some grant proposal data, the UIUC approach was adaptable enough and the overall ROI was calculated as €0,17 for every Euro invested in the materials budget between 2006 and 2009.

Also inspired by the UIUC methodology, a recent study at the University of Colorado adopted a cost avoidance approach in its cost-benefit analysis of the library's journal subscriptions (Pan et al., 2013). Citation analysis was used to find the number of article references in faculty research papers that had been sourced from library subscriptions, and ROI calculations were then based on an average price that faculty would have to pay for the articles if the library did not subscribe. ROI figures for three campus libraries ranged from -19% to 144%.

Health Libraries

Kelly et al. (2012) identify only a handful of health library ROI studies, the earliest of which is an analysis by the Department of Veterans Affairs (VA) hospital libraries in the US (Jemison, Poletti, Schneider, Clark, & Stone, 2009). ROI was calculated using both clinician time saved and cost avoidance methods, the latter in relation to use of the library's collections, with a resulting CBR of 1 : 4.1, and ROI ranging from 201% to 450% for three VA libraries. The time saved approach was also taken by the University of Maryland Health Sciences and Human Services Libraries (Bodycomb & Del Baglivo, 2012), although in this case an online ROI calculator (National Network of Libraries of Medicine [NNLM], 2013) was used to estimate user time saved for each book borrowed. The results revealed a CBR of 1 : 23.3 and ROI of 2,234% for 2011, although the calculations did not include indirect costs.

The cost avoidance method, meanwhile, has been used in a cost-benefit analysis of a library's journal collection at a paediatric hospital in Atlanta (Daniels, 2010). An estimated cost of purchasing articles directly from a publisher was used to calculate a CBR of 1 : 2.76.

Also using both time saved and cost avoidance methods, an independent ROI assessment of 300 Australian health libraries commissioned by ALIA with results published in the report *Worth Every Cent and More* (ALIA, 2013), is perhaps the most influential health library ROI study of recent years. The ROI figure presented by the report - $9 for every $1 invested – has often been cited (see for example HEE, 2015; HLWIKI International, 2015; Murray, 2013), and it is worth noting that problems associated with time saved and cost avoidance methods, while not completely resolved by the study, are nevertheless recognised, with some attempt made to produce a conservative and therefore credible estimate for ROI. For example, while the quoted ROI/CBR calculation assumes that users may take 3.3 times longer than library staff on literature searching, the report also contains a lower CBR estimate of 1 : 2.7, arrived at by assuming the same time for staff and users alike (SGS Economics and Planning, 2013, p. 9).

Other Library Sectors

The literature in other sectors, meanwhile, such as corporate, legal, or technical libraries is sparse. Ryan describes a time saved approach to calculate cost savings in a corporate library, and an ROI of £6 worth of executive time saved for every £1 spent on information services (2006); sometimes special libraries are included in a single calculation, such as an

independent Australian study which calculated a national ROI of $5.43 for every $1 invested in special libraries, using a combination of time saved and cost avoidance methods (ALIA, 2014). School libraries, meanwhile, have tended to focus on impact in relation to student learning (Oakleaf, 2010, p. 58).

In the narrow field of national libraries, a 2003 British Library study is widely considered a benchmark, especially in relation to CV methodology (BOP Consulting, 2014, p. 16); looking at the total economic value to users, non-users and the economy as a whole, the library's CBR was calculated as 1 : 4.4, or £4.40 generated for the UK economy for every £1 of public funding (Pung et al., 2004).

2.1.3 Library ROI methods

The variety of methods highlighted above, used for calculating the *gain on investment* for CBR or ROI calculations, will now be examined in more detail.

Grant income

Pioneered by UIUC, this method connects the use of library resources with the use of citations in successful research grant proposals, and the median revenue generated with each use of the library is then used to calculate the ROI on the library's subscriptions to research journals. One drawback of this method, highlighted by Grzeschik's study (2010) and the second phase UIUC study at 8 universities (Tenopir et al., 2010), is the difficulty of applying the model to other institutions.

Time saved

This method requires that the data regarding library users' salaries (or household income, in the case of public libraries), can be collected. Accurate estimates of the amount of time the user actually saves are difficult to achieve, but Matthews highlights the fact that, since the cost of an information professional's time is usually less than that of the library user, this is an area where improved productivity and overall efficiency can often be demonstrated (2007, p. 301).

Cost avoidance

Sometimes called the *cost savings* or *market substitute* approach, cost avoidance attempts to estimate the amount of money saved by users when they use the library instead of an alternate

source (Strouse, 2003, p. 17). However it should be noted that this makes an assumption that the user would in fact make the purchase as an alternative (as pointed out by Kelly et al., 2012; Keyes, 1995; McIntosh, 2013; Neal, 2011); Urquhart puts the case quite clearly: "if [the user] would not have bothered to find alternatives, the cost savings have to be considered as zero" (2005, p. 28). Making assumptions about this kind of saving can lead to serious questions of validity and credibility; McIntosh found that the cost avoidance approach led to an estimation of benefits more than four times the amount expected based on a CV survey (2013, p. 122).

Matthews also highlights the problem of overestimating savings based on purchase price, and identifies some interesting examples where more realistic values are achieved by taking a percentage of the purchase price, such as 10% or 25% in the case of items being loaned (2007, p. 312–313); however, such discounts may be viewed as arbitrary and inconsistent (McIntosh, 2013, p. 118).

Occasionally, cost avoidance is confusingly identified as the CV method; Pan, Ferrer-Vinent and Bruehl, for example, in a study of academic library value in relation to teaching and learning outcomes, state that they applied the CV approach, whereas the methodology utilises the alternate costs of downloading articles directly from the publisher via pay-per-view to identify savings – clearly the cost avoidance method, and not the CV method as it is usually defined. Not surprisingly, considering the pay-per-view costs of most publishers, this study derived a very high ROI of 2,324% (Pan, Ferrer-Vinent, & Bruehl, 2014).

Most of the ROI calculators found online use some form of the time saved or cost avoidance methods in their calculations; for example, the NNLM ROI calculator uses both methods (Bodycomb & Del Baglivo, 2012; Kelly et al., 2012), and there are obvious difficulties with trying to cover a diversity of libraries and contexts with an easy-to-use calculator (Jemison et al., 2009, p. 382).

Consumer surplus

This may be defined as "a user's expression of the value of a specific service in excess of what they would pay for it" (Kelly et al., 2012, p. 663), or more broadly "the benefits consumers enjoy over and above the price they pay for a good" (Pung et al., 2004, p. 83). Consumer surplus and CV are often conflated or linked closely together, with some authors explicitly defining CV as quantifying consumer surplus (for example Kingma, 2001, p. 40),

while others describe CV as just one method of measuring consumer surplus (Pung et al., 2004, p. 84).

Opportunity cost

Occasionally used in combination with other methods, this describes the cost of the opportunity lost when something is *not* purchased (Carrigan, 1992, p. 294). Often overlooked, opportunity cost assessment is "fundamental to assessing the true cost of any change" (NHS Institute for Innovation and Improvement, 2010, para 45).

Other methods

More complex methods of secondary economic impact analysis for calculating direct or indirect benefits to local economies, such as the REMI tool used in the Florida public libraries studies (Imholz & Arns, 2007, p. 16; Pooley et al., 2010), or the *multiplier effect* (also known as the *halo effect*), which considers the "magnification of direct spending" in the local economy due to the presence of a library (Holt et al., 1996, p. 5), are beyond the scope of this study. There are a number of techniques, however, which are often discussed in conjunction with CV:

Revealed preference techniques use "market information to derive values" (Pung et al., 2004, p. 84), such as changing demand due to price changes, and are not readily applicable to non-market services such as libraries (Ko et al., 2012, p. 118); however, the *travel cost* method, generally considered a form of revealed preference (BOP Consulting, 2014, p. 14; HM Treasury, 2003, p. 57), can be an important element to consider when calculating potential cost savings in relation to the cost of travelling, both to the library or to an alternate source (Missingham, 2005, p. 146).

Stated preference techniques are usually appropriate if the market information required for a revealed preference approach is not possible (Pung et al., 2004, p. 84). The techniques rely on asking people hypothetical questions about a range of choices in order to evaluate a particular good, benefit, or service (Pearce & Ozdemiroglu, 2002, p. 10). There are two main types of stated preference technique: the first, *choice modelling*, elicits preferences with regard to individual characteristics, elements or attributes of a good or service; the second, *contingent valuation*, focuses on the good or service as a whole (Pearce & Ozdemiroglu, 2002, p. 12), and will be considered in detail in the next section.

2.2 Contingent Valuation (CV)

2.2.1 Defining Contingent Valuation

Missingham describes CV as "an economic methodology used to estimate the value that a person places on a good or service," by asking "how much individuals would be prepared to pay … in order to secure the provision of a public good [or service]" (2005, p. 145). The question is asked within the context of a hypothetical, but plausible, situation (Mitchell & Carson, 1989, p. 3), and can either attempt to elicit an individual's willingness-to-pay (WTP) for a good or service, or the extent of their willingness-to-accept (WTA) compensation for not having the good or service (Markless & Streatfield, 2013, p. xxii). CV studies can elicit WTP or WTA amounts using surveys or interviews, with direct questions such as "What is the maximum amount you would be prepared to pay every year to receive good X?" (HM Treasury, 2003, p. 57)

In general, WTP amounts tend to provide lower – and therefore more conservative - values than WTA (Arrow et al., 1993; Ko et al., 2012; Poll & Payne, 2006), as one might expect given that an individual's personal WTP may be restrained by budgetary considerations (Pung et al., 2004). In most CV studies, therefore, the WTP approach is used, and indeed was the approach recommended by the influential NOAA (National Oceanic and Atmospheric Administration) panel (McIntosh, 2013).

Set up in 1992 to assess the reliability of the CV technique method and review its application in the context of determining the impact of oil spills in the US (Missingham, 2005), the NOAA panel's recommendations came at a time when the method had become the standard approach in valuing non-private goods, especially environmental resources (Arrow et al., 1993, p. 4; McIntosh, 2013). The technique itself was originated by Robert K. Davis in the early 1960s, in relation to the benefits of outdoor recreation in Maine (Mitchell & Carson, 1989, p. 9); since then thousands of CV studies have been conducted in over 130 countries (Carson, 2012, p. 28), and it is included in HM Treasury's "Green Book" of guidance on the appraisal of public spending (HM Treasury, 2003, p. 57).

As well as environmental and more recently library studies, CV has been used in relation to transportation (Pearce & Ozdemiroglu, 2002) and health economics. In the latter area, there is a diverse range of conditions and treatments that have been examined, including childhood obesity (Cawley, 2008), diabetes (Chang, 2010), the value of informal care in Alzheimer's

disease (Gustavsson et al., 2010), and implantable cardioverter-defibrillator therapy (Nowakowska et al., 2011). The continued use of CV, therefore, and the accumulated body of evidence "… now supports the view that contingent valuation done appropriately can provide a reliable basis for gauging what the public is willing to trade off to obtain well-defined public goods" (Carson, 2012, p. 40). But as Carson concedes in the same paper (2012), the method is "not perfect" (2012, p. 40), and there are drawbacks as well as benefits to the use of CV.

2.2.2 Benefits and Drawbacks of CV

While some authors such as Ko et al. conclude that CV "appears to be a reliable and effective means with which to derive economic value of public services" (2012, p. 123), and "as accurate as other available methods" of determining the value placed on public goods (Mitchell & Carson, 1989, p. 2), the main benefits of CV are related to the fact that, when compared to other methods such as time saved and cost avoidance, it results in stated and direct values (Matthews, 2007, p. 304) rather than inferred values, and tends to produce lower, and therefore more conservative, valuations (Aabø, 2009; Fujiwara et al., 2015; McIntosh, 2013). In addition, having gained wider acceptance following the NOAA panel assessment and subsequently widely researched and applied across a range of public sector goods and services, it has a level of credibility with "the potential to gain the most traction with national government stakeholders" (Ashley & Niblett, 2014, p. 88), as well as funding bodies and stakeholders at an organisational level.

But the method has significant drawbacks which cannot be easily ignored. Ashley and Niblett (2014, p. 88) highlight three challenges to the effective use of CV:

- The method can be very expensive to implement, especially when evaluating whole services, requiring time and staff resources for data collection and analysis (see also Kim, 2011; Missingham, 2005)
- It can be very complex to ensure credible standards are maintained
- The robustness of studies can be compromised by a range of methodological weaknesses and biases

Often the hypothetical, and therefore speculative, nature of the WTP scenarios is seen as a key weakness (Fujiwara, Kudrna, & Dolan, 2014, p. 7; Levin, Driscoll & Fleeter, 2006; Mitchell & Carson, 1989, p. 15), and there is a wide range of potential biases associated with

CV which will be discussed in chapter 3. Nevertheless, Mitchell and Carson point out that "there is no valid basis for dismissing the method out of hand on these grounds" (1989, p. 15), and the CV method continues to be refined and applied in many areas.

2.2.3 Library CV Studies

While most library CV studies share a common hypothetical scenario which "typically claims that the library will be closing due to natural disasters or budget issues" (Ko et al., 2012, p. 118), there is considerable variation in the specific CV techniques applied, particularly in relation to the WTP elicitation methods used; the following table provides a summary:

Author	Year	Country	Library Sector	Elicitation Method
Harless & Allen	1999	US	Academic	Payment card
Holt, Elliott & Moore	1999	US	Public	Open-ended
Pung, Clarke & Patten	2004	UK	National	Referendum vote followed by open-ended
Jura Consultants	2005	UK	Public	Payment card
Aabø	2005	Norway	Public	Referendum vote
Chung	2007	Korea	Special	Payment card
Chung	2008	Korea	Public	Open-ended
Hider	2008	Australia	Public	Referendum vote
Lee, Chung & Jung	2010	Korea	Public	Payment card
Ko et al.	2012	Korea	Public	Double-bounded dichotomous choice
McIntosh	2013	US	Public	Double-bounded dichotomous choice
Hajek & Stejskal	2014	Czech Republic	Public	Referendum vote followed by open-ended
Fujiwara, Lawton & Mourato	2015	UK	Public	Payment card

Table 3: Library CV Studies

Clearly, the bulk of CV library studies have been undertaken within the public library sector, often in conjunction with other methods such as *consumer surplus* (for example Holt et al.,

1999; Jura Consultants, 2005). The lack of CV research in health libraries played a significant part in determining the methodological approach of the present study, and this will be described in more detail in the next chapter, along with a discussion of the various elicitation methods, and the strategies that have been developed to reduce bias.

Chapter 3: Methodology

From the literature review, it is clear that contingent valuation (CV), while certainly not without problems, is an important and widely used method for estimating the economic value of non-private goods and services, which can be applied as part of a calculation of return on investment (ROI). Given the fact that CV has not previously been implemented as part of any health library evaluations, it therefore offers an interesting and novel approach in the context of this study.

This chapter looks in detail at the research approach taken, from theoretical background to the CV methodology itself, and the choices made in terms of elicitation methods and sampling. Since the CV survey data is only one part of the ROI calculation, service costs are also considered, as well as stakeholder input via semi-structured interviews. Finally, the ethical considerations of this research approach are identified and discussed.

3.1 Choice of Research Approach

The research undertaken for this study employs a mixed methods approach, comprising interviews with stakeholders and other organisational experts to obtain a qualitative account of library value in the context of organisational aims and values, alongside a CV survey aimed at capturing library users' willingness to pay (WTP) for an aspect of the library service, providing a quantitative measure of estimated value which can be utilised in an ROI calculation. Before moving on to consider these methods in more detail, the theoretical foundations of mixed methods research are examined.

3.1.1 Theoretical Background

Mixed methods research uses both quantitative and qualitative methods. *Quantitative* research is often associated with the natural sciences and a positivist epistemological stance (Bryman, 2012, p. 27), where only knowledge about phenomena confirmed by the senses is considered acceptable knowledge. Theories about these phenomena are tested deductively through the development of hypotheses that are either confirmed or rejected after empirical data has been collected and analysed (Bryman, 2012, p. 24).

Qualitative research, meanwhile, tends to be associated with contrasting epistemological and ontological positions. Instead of one independently existing external reality, multiple versions

of reality are seen as "constructions" by individuals and groups (Clarke & Dawson, 1999, p. 39), as well as by researchers themselves (Bryman, 2012, p. 33). Inductive, rather than deductive, reasoning leads to theory as the outcome of research, rather than the starting point (Bryman, 2012, p. 26).

When used together in mixed methods research, these two approaches can be "mutually illuminating" (Bryman, 2012, p. 628), and increasingly, "evaluators are exhorted to use whatever methods appear to be best suited given the nature and context of the evaluation situation" (Clarke & Dawson, 1999, p. 62).

3.1.2 Choice of Service to Evaluate

One crucial aspect of the overall research approach involved making a decision on which particular library service or function to evaluate. While many large scale library ROI studies such as the Florida public libraries study (Griffiths et al., 2004) and the British Library study (Pung et al., 2004) had the resources to conduct research into the overall ROI of the whole library service, this was clearly impractical within the scope of this study, and given the exploratory nature of the research into ROI and the use of the CV method, it was deemed sufficient that just a single service be evaluated. Other studies have similarly focused on single services, such as a reference desk service (Harless & Allen, 1999), and book and journal collections (Bodycomb & Del Baglivo, 2012).

The library's out-of-hours access service was chosen as an appropriate service for an ROI evaluation; only a very small number of previous studies were found related to library out-of-hours access, most of which were related to implementations rather than evaluations (see Adamson & Bunnett, 2002; Archer, 2004; Laaker, 2011). This therefore presented a further opportunity for some research into an aspect of library services not routinely discussed in the literature.

3.2 Methods

3.2.1 Stakeholder Interviews

Interviews are particularly useful for gathering "qualitative, descriptive, in-depth data that is specific to the individual" (Pickard, 2007, p. 172), and "used frequently in information and library research" (Pickard, 2007, p. 171). For the purposes of this research, the semi-

structured interview was selected as an appropriately flexible method of eliciting useful responses using a list of questions, while allowing the interviewee "a great deal of leeway in how to reply" (Bryman, 2012, p. 471). This was important, as the specific topic being covered – demonstrating value – may mean different things to different interviewees, and could present opportunities for the interviewer to pick up on things said and expand on them beyond the scheduled questions.

The interviews themselves were designed to be short – given the demands on interviewees' time in the workplace – with six questions:

1. How important is it for the library service to demonstrate its economic value to the Trust?
2. How useful would a Return on Investment percentage or Cost-Benefit Ratio be in this regard?
3. How could this data be presented to the Trust?
4. Are you familiar with the Contingent Valuation method? If so, how useful do you think this technique is, in terms of calculating value?
5. Are there any other economic evaluation methods that you are aware of, that the library could use to demonstrate value?
6. What other types of value should the library be seeking to demonstrate?

The questions are either intermediate or open-ended (as defined by Bryman, 2012, p. 279), and the interview schedule sheet (Appendix A) contained several pre-determined prompts (Markless & Streatfield, 2013, p. 141) such as, for question 4, a prompt for the interviewer to provide more information and examples about the contingent valuation method, if required to supplement the background information already provided in the information sheet (Appendix B). Since the recording method comprised of note-taking, the interviewer used a note pad ready prepared with spaces for topic themes and verbatim quotes, as recommended by Pickard to reduce the risk of missing important data while writing things down (2007, p. 177).

A pilot interview was undertaken to test the flow of questions and for the interviewer to gain experience (Bryman, 2012, p. 474); subsequently snowballing sampling was used to identify additional interviewees via suggestions by the initial key stakeholders (Pickard, 2007, p. 65). In terms of sample size, only a small sample was intended (up to 6 interviews), since the objective was to gain sufficient qualitative contextual background to the main CV survey

research, rather than attain a particular statistical confidence level through probability sampling.

3.2.2 User Surveys

In contrast, the CV survey attempted to use probability sampling to improve the reliability and validity of the data (Bryman, 2012, p. 181), and particularly for the potential of generalising the sample willingness-to-pay (WTP) mean to the population WTP mean.

In this case, the population consisted of all the library users who – at the time of sampling – had a library out-of-hours access card on loan to them (N=305). Note that other library users, and other staff in the organisation, have been omitted in line with the limited scale of this research; however *option value* is an important component which should not be overlooked in further studies.

The sampling frame was easily generated from the library management system (LMS) by running a report on all the access cards on loan. Each access card has a unique 5 digit number, and the list of cards on loan was copied from the LMS report to an Excel 2010 spreadsheet. The sample size itself was calculated using an online tool recommended by Urquhart and Weightman (2008), the *Sample Size Calculator* (Creative Research Systems, 2012), and a sample size of n=73 was arrived at, based on the following parameters:

Population	305
Confidence Level	95%
Confidence Interval	10

In other words, assuming the random sample has a normal distribution around the sample mean, there will be a 95% probability that the population mean will lie within a range of + or - 10 around the sample mean (Bryman, 2012, p. 197). While the 95% confidence level is typically employed by survey researchers (Bryman, 2012, p. 196), a greater sample size of n=152 could be used to reduce the confidence interval to 5, thereby narrowing the range of possible values for the population mean by reducing the sampling error and hence improving the estimate (Sapsford, 1999, p. 64); however, the sample size of 73 was deemed acceptable for the purposes of this research.

In order to generate the sample from the sample frame, the Excel RANDBETWEEN function (Microsoft, 2015) was used to randomly select 73 access cards from the list of cards on loan. The unique access card numbers where then used to identify the sample users' email addresses via the LMS, so that a hyperlink to the online survey could be sent electronically.

An online web-based survey was chosen, as opposed to a paper-based survey, for reasons of convenience in terms of survey creation, administration and data analysis, as well as the fact that response rates and quality of responses can be the same, if not better than paper-based surveys (Weightman, Urquhart, Spink, & Thomas, 2008, p. 66), although Bryman points to evidence that suggests the contrary in comparison with postal surveys (2012, p. 674). Another potential issue with online surveys raised by Bryman is related to sampling bias due to variations in access to email and the web (2012, p. 673); however, the total population of library users here have already provided email addresses when registering with the library, and library notifications such as due date reminders are routinely sent via email.

It is worth noting that the NOAA panel specifically recommended the use of face-to-face or telephone interviews for CV questionnaires (Arrow et al., 1993, p. 30), although as noted by McIntosh, strict adherence to NOAA recommendations is not always possible or reasonable (2013, p. 119), and in this case the online survey presents a more pragmatic approach within the scope of the study.

The online survey itself was created using SNAP Survey software (Snap Surveys Ltd, 2015b), and distributed initially as a pilot survey to three users for feedback and comments. Following this, the online survey was distributed to the random sample of 73 users; however, after several weeks, and despite a follow-up email, the response rate was poor (less than 20% of the sample). Therefore, the link to the online survey was redistributed to the remainder of the entire population in attempt to increase the number of responses. The obvious drawback to this approach is that the sample becomes biased due to non-responses and therefore ceases to be a probability sample (Sapsford, 1999, p. 95), impacting on the external validity of the research (Pickard, 2007, p. 21). The implications of this will be looked at in more detail in the results chapter.

In terms of the design of the survey itself, the next section will look closely at the key elements of CV surveys, as well as the methodological implications of those errors and biases that are unique to it.

3.3 The Contingent Valuation Survey

Already touched upon in chapter 2, contingent valuation is a method for estimating the economic value of a good or service by eliciting the amount that an individual is willing to pay (WTP) for it, in the context of a hypothetical situation. For the purposes of this study, the service in question is the library's out-of-hours access service, and the hypothetical situation presented in the survey is that the library needs to charge a fee for the use of an access card, in order to keep the service operational. Currently, users only have to pay a £10 deposit for use of a card for up to one year, and it is worth noting that this transaction in relation to access cards may make it easier for users to imagine paying a fee – unlike other "free at the point of contact" services which are more difficult to value – but the existing £10 deposit may have an "anchoring" effect in relation to WTP amounts.

A key element of any CV survey is the method by which WTP (or WTA) is elicited. The method chosen for this survey is the *payment card*, which presents a range of possible amounts and the user selects the one closest to their maximum WTP. Other methods are available – the payment card is not necessarily the best - and it is important to consider each one, since there are a range of methodological issues connected to each which can have an impact on the validity of WTP data (Lee, Chung & Jung, 2010, p. 236).

3.3.1 Elicitation Methods

Open-Ended Format

This format simply asks respondents to state their maximum WTP (or minimum WTA). The format suffers from the problem that "respondents often find it difficult to pick a value out of the air, as it were, without some form of assistance" (Mitchell & Carson, 1989, p. 97), and there is a tendency for it "to produce an unacceptably large number of non-responses or protest zero responses" (Mitchell & Carson, 1989, p. 97). In addition, Pearce and Ozdemiroglu note a number of other problems encountered with the format, such as unrealistically large amounts (2002, p. 50).

Referendum Vote

The format recommended by the NOAA panel, this is "a dichotomous question that asks respondents to vote for or against a particular level of taxation" (Arrow et al., 1993, p. 53), although the question can be used with prices as well (for example Greenberg, Bakhai, Neumann & Cohen, 2004).

Also known as the *Take-It-or-Leave-It approach* (Mitchell & Carson, 1989, p. 101), it often features a number of pre-determined prices which are then randomly assigned to respondents; Greenberg et al., for example, use three different prices (2004), while Yen et al. use 9 (2007). The referendum vote has been criticised for not eliciting actual maximum WTP amounts, and being susceptible to non-zero yea-saying (Mitchell & Carson, 1989, p. 101).

Bidding Game

Here, respondents are asked an initial referendum-style question in relation to a given price; if the response is "yes", then a second higher amount is offered, then a third, until the respondent gives a "no" response (thereby indicating that the last "yes" vote is their maximum WTP). For WTA amounts, this process happens in reverse until the minimum amount is reached. While not used nearly as much as other formats, it is still utilised in some cases (for example Whynes & Sach, 2007), but is often criticised for being prone to anchoring or starting point bias (Mitchell & Carson, 1989, p. 99; Pearce & Ozdemiroglu, 2002, p. 51).

Double-Bounded Dichotomous Choice (DBDC)

This is effectively a combination of referendum and bidding game approaches, the double-bounded dichotomous choice format presents respondents with an initial "yes" or "no" bid for a particular amount, followed by a single follow-up bid amount which is either higher (if the first response is "yes") or lower (if "no"). Again, this approach may be prone to anchoring bias (McIntosh, 2013, p. 120), but as with other formats, using a randomly selected starting amount from a range of baseline values goes some way to mitigating this effect (see for example Ko et al., 2012).

There is some agreement that the DBDC method improves statistical efficiency in terms of calculating mean WTP (see for example Bateman, Burgess, Hitchinson, & Matthews, 2008; McIntosh, 2013), and has certainly "become one of the most prevalent of all CV designs"

(Bateman et al., 2008, p. 130); for recent applications in the healthcare sector, see Cawley (2008), Chang (2010), and Schwarzinger, Carrat and Luchini (2009).

Payment Card Method

This method presents respondents with a range of monetary values, from which they select their maximum WTP amount, although there are slight variations; for example Pearce and Ozdemiroglu give an example where respondents are asked to tick all the amounts they would be willing to pay, to put a cross next to any amount they definitely would *not* be willing to pay, and to leave blank any amount that they are unsure of (2002, p. 51). In some cases, the payment card also includes benchmark values or prices which are used to inform or remind respondents about the cost of comparable goods or services (Ko et al., 2012). Whatever approach is used, the payment card is generally regarded as a useful visual aid to the process of valuing (Bateman et al., 2002, cited in Fujiwara et al., 2015, p. 16), and less prone to anchoring bias, although "potentially vulnerable to biases associated with ranges used on the cards and the location of the benchmarks" (Mitchell & Carson, 1989, p. 101).

According to Pearce & Ozdemiroglu, both payment card and DBDC methods can be recommended (2002, p. 50); for the current study's CV survey (see Appendix C), the payment card was chosen, with a range between £0 and £50, and incremental steps of £1 initially, then increasing to £2.50, then finally £5:

☐ £0	☐ £10	☐ £30
☐ £1	☐ £12.50	☐ £35
☐ £2	☐ £15	☐ £40
☐ £3	☐ £17.50	☐ £45
☐ £4	☐ £20	☐ £50
☐ £5	☐ £25	☐ Other amount

Figure 1: Payment Card

3.3.2 Reliability and Validity

Pearce and Ozdemiroglu define *reliability* as the "degree of replicability of a measurement" (2002, p. 78), and *validity* as the degree to which it succeeds in measuring the intended quantity, and while it is common to express this in terms of internal and external validity (Pickard, 2007, p. 21), Bryman lists five different types (2012, p. 171): Face, concurrent,

predictive, construct and convergent. Of particular interest are three of these types, discussed by several authors, such as Philips et al. (2006, p. 195-196) and Mitchell and Carson (1989, p. 190) in the context of CV:

Type	Description
Face (or Content) validity	The extent to which all factors relevant to the study are taken into account by the survey instrument; Pearce & Ozdemiroglu describe it as asking "the right questions in a clear, understandable and appropriate manner" (2002, p. 79).
Concurrent (or Criterion) validity	According to Philips et al., this is "the ability of the instrument to capture values that are … representative of the actual amount of money individuals would be willing to give up" (2006, p. 195).
Construct validity	Whether the survey is able to generate WTP values that follow expected patterns (Pearce & Ozdemiroglu, 2002, p. 79); or to put it another way, the degree to which the measure relates to other measures as predicted by theory (Mitchell & Carson, 1989, p. 191).

Table 4: Types of Validity

While statistical and regression analysis can be used to demonstrate both the reliability and validity of WTP data once collected (Mitchell & Carson, 1989, p. 209-213), both can also be improved at the survey design stage, by anticipating potential biases and introducing moderating elements accordingly.

3.3.3 Potential Biases and Errors

There are a range of biases and errors associated with sampling and surveys in general. Bryman identifies four types of error that can affect survey research (2012, p. 205):

1. *Sampling errors* – resulting in an unrepresentative sample
2. *Sample-related errors* – caused by an inaccurate sampling frame or non-responses
3. *Data collection errors* – related to the implementation of the data collection instrument

4. *Data processing errors* – caused by the mismanagement of data once it has been collected

CV surveys are susceptible to a range of unique errors which are largely a form of data collection error, in that they are specifically linked to the way that the survey collects the WTP data from respondents, potentially leading to the following types of bias:

Type of Bias	Description
Hypothetical Bias	A result of the hypothetical nature of WTP questions, leading to "off-the-cuff" and meaningless answers which critics of CV argue lead to overstatements of value (Hausman, 2012, p. 43). However other authors, such as Mitchell and Carson, maintain that "most respondents, if they are given the chance to say they don't know, will stop short of giving meaningless answers" (1989, p. 173), and a "Don't Know" or "No answer" option is usually a recommended feature of CV surveys (see also Arrow et al., 1993, p. 34).
Anchoring or Starting Bias	This particularly affects the DBDC method, where "respondents may become fixated on the first … amount as a signal of what their own true WTP should be" (McIntosh, 2013, p. 120). The usual strategy for avoiding this is by randomising the starting bids for respondents (Ko et al., 2012), and some studies have used regression analysis to test for an anchoring effect (for example Chang, 2010).
Strategic Bias	Said to occur where a respondent attempts to skew the overall study by "providing values that they think will influence the final resource allocation decision" (Fujiwara et al., 2014, p. 13); however, according to Mitchell and Carson, this is not usually a significant problem for CV studies (1989, p. 170).
Information Bias	Where respondents are unfamiliar with the services being valued, the lack of information may bias their answers; sometimes called *framing bias*, this effect can generally by controlled by providing sufficient background information in the survey (Chung, 2008), however another type of error – *scenario misspecification* – is a potential problem where the information provided is inaccurate or perceived in a way that is not intended by the researcher (Mitchell & Carson, 1989, p. 246).

Range Bias	Associated with the payment card method and the range of values displayed; Mitchell and Carson (1989, p. 241) describe how a respondent's actual WTP amount may not be shown, forcing them to choose either a higher or lower amount. In addition, the maximum value on the card may be taken as an "upper bound" by the respondent, inducing them to give a higher WTP than they might otherwise have done if the maximum value was lower. However, a sufficiently large selection of values, along with a representative sample, should control for the effect of range bias in the calculation of sample WTP means and medians (Mitchell & Carson, 1989, p. 243).
Scope Bias	Where WTP values appear to be generally insensitive to the size of the good or service being valued (Fujiwara et al., 2014, p. 13). Hausman cites an environmental example where the WTP for cleaning up one lake is approximately the same as the WTP amount for cleaning up five lakes (2012, p. 47); he goes on to say that the lack of an expected "scope effect" calls into question the credibility of WTP and the CV method in general. In addition, there is a related "embedding effect" whereby WTP amounts appear to vary depending on whether the good is evaluated on its own or as part of a package (Hausman, 2012, p. 47).
Protest Bidding	Sometimes called *protest voting*, this type of activity occurs when a respondent does not trust the purpose of the survey or study (McIntosh, 2013, p. 121), and is usually characterised by a zero WTP amount. Questioning techniques have been developed to attempt to separate out the protest zeroes from genuine WTP zero amounts (Harless & Allen, 1999), so that once identified, they can be excluded from the analysis (Pearce & Ozdemiroglu, 2002, p. 34).
Free-riding	Describes the situation where respondents assume someone else will pay for or fund a service, even if they choose not to support it (Matthews, 2007, p. 305). The free-riding problem is more likely to affect studies where the WTP question relates to public goods or services being paid for by voluntary donations (McIntosh, 2013, p. 123), and it has been argued that it is "the exception rather than the rule in all the experiments reviewed" (Mitchell & Carson, 1989, p. 150).

Yea-saying	Occurs when respondents give a "yes" response, or a higher bid than their true WTP amount, in order to please the researcher (Pearce & Ozdemiroglu, 2002, p. 33). Additional questions, such as "how certain are you that you would pay this amount?", can be added after the WTP question, to try and assess the respondent's certainty in their WTP amount, and many studies will only consider a "yes definitely" answer as a positive response (see for example Greenberg et al., 2004).

Table 5: Types of Bias Affecting CV Surveys

3.3.4 Survey Format and Layout

All of the above biases were considered during the development of this study's CV survey (Appendix C), and several strategies were employed to reduce their impact.

The survey begins with an introduction which outlines the aims of the survey, along with a reminder about the out-of-hours access card service, including the £10 deposit currently paid, in order to reduce information bias. This is followed, in line with other CV surveys (such as Jura Consultants, 2005, p. 14; Lee et al., 2010; Pung et al., 2004), with a series of profiling and usage questions.

The first question (Q1) asks for the respondents' job category; this is a "stratifying criterion" (Bryman, 2012, p. 192) for comparison with the population's overall breakdown and to indicate the level of proportional representation in the responses. The next three questions (Q2 – 4) are related to independent variables which one may expect will have some correlation with WTP amounts, and which can be used in the regression analysis:

Q2. How long have you had a 24 hour access card?
Q3. How close do you live to the library?
Q4. Which pay band or pay range are you in?

Questions 5 – 8 are traditional usage and evaluation questions, to be used for calculating elements of the service costs (such as the cost of using computers), and providing additional qualitative and quantitative feedback about the out-of-hours access service.

The CV section itself begins after question 8, and follows a similar structure to other CV surveys (for example Fujiwara et al., 2015), beginning with a statement about the hypothetical scenario:

> *The following questions are designed to help value the 24 hours access card service. They are based on the **hypothetical** situation in which the library has to consider charging in order to keep the access card service operational. They are **not** an indication that charges will be introduced in reality.*

Question 9 is a *dissonance minimising* question, designed to allow respondents to express support for the service without having to commit to a payment (Hider, 2008, p. 446), and therefore reduce yea-saying and protest bidding (Chung, 2008, p. 74). A "don't know" option is also included:

> *Q9. Would you be prepared to make an annual payment for the access card (i.e. not a deposit)?*
>
> *Yes – I value out-of-hours access and would be prepared to make an annual payment* ☐
>
> *No – I value out-of-hours access but cannot afford to make an annual payment* ☐
>
> *No – I value out-of-hours access but would rather spend my money on other things* ☐
>
> *No – I would not mind if out-of-hours access was not available* ☐
>
> *Don't know / not sure* ☐

If a respondent selects any of the "No" or "Don't know" options, the survey ends. If they select "Yes", then the survey routes to the payment card question (Q9a), introduced with some text in line with the *cheap talk* technique. This is a way of controlling yea-saying and hypothetical bias, by minimising respondents' overestimation of WTP (Hider, 2008, p. 446); Ozdemir et al. call it an attempt "to engage subjects in the research problem and to motivate them to devote more effort, attention, and imagination to the preference-elicitation task", and they conclude the technique has the potential to reduce bias and improve data quality (2009,

p. 895). In this case, the cheap talk text also includes a reminder that there may be alternatives to the library:

> *Although this is a hypothetical question, please think about the amount as if you were actually making a payment for real. Please do not agree to pay more than you would in reality, or an amount that you might not be able to afford. Remember that there might be something else that you would rather spend this money on, or that you might have somewhere else to do your work if the library is not open in the evenings or at weekends.*

The payment card itself ranges from £0 to £50, with 17 possible amounts to choose from; this was considered a sufficiently large scale of values to avoid range bias, although an added "other" option does give the respondent the opportunity to add an open-ended response. In terms of anchoring bias, there is the potential for the £10 deposit already paid to act as an anchor for WTP amounts; if so, this will be apparent in the data analysis and should provide useful information when considering the development of other CV studies in the future.

Finally, a certainty question rounds off the survey (Q10), once again to control for a variety of biases described above. In line with other studies (for example Lee et al., 2010), only "very certain" responses are included in the final WTP estimation.

3.4 Service Costs

Although the CV survey and subsequent analysis comprises the bulk of this study, the WTP values generated are just one part of the ROI calculation; the total service costs also need to be calculated, and moreover they need to be "fully loaded" as defined by Phillips and Phillips, to ensure a conservative ROI estimate and an overall credible approach (2007, p. 30). These include the initial start-up costs, when the system was implemented in 2013, plus the ongoing marginal cost of the access cards themselves.

In addition, there is a cost in terms of staff time required to manage the service, by way of issuing cards, collecting deposits, ordering new cards, and other associated administrative tasks such as following up overdues. A costing template from the *NHS Library and Knowledge Services Wiki* (2015) was used to calculate these costs.

Data from the usage section of the CV survey will be used to identify the approximate costs of consumables and power usage through the use of computers and printers when the library is accessed out-of-hours; estimations will be based on similar calculations by a university IT Service (University of London, Birkbeck [BBK], 2014).

Finally, it will be noted that there is an element of income generation to the existing out-of-hours service since some users either lose or fail to return their access cards. In these cases, the £10 deposit is retained by the library and hence it is subsequently identified as income in the library budget. The total amount of income through retained deposits for the period in question will therefore be deducted from the overall service cost figure prior to the ROI calculation.

3.5 Ethical Considerations

The following ethical policies and guidelines were followed in the course of this dissertation:

- *Aberystwyth University, Department of Information Studies (DIS) – Ethics Policy for Research* (DIS, 2014)
- *British Sociological Association (BSA) – Statement of Ethical Practice* (BSA, 2002)
- *British Psychological Society (BPS) – Code of Ethics and Conduct* (BPS, 2009)
- *Chartered Institute of Library & Information Professionals (CILIP) – Ethical Principles* (CILIP, 2013b)
- *CILIP – Code of Professional Conduct* (CILIP, 2013a)

As well as informing the overall conduct of the research, the guidelines were used in the development of the interview consent form (Appendix D), schedule (Appendix A), information sheet (Appendix B), and introduction to the online survey (Appendix C). The layout of these documents was also largely based on templates found in Urquhart and Weightman's best practice guidance for NHS library impact assessments (2008), as well as Bryman (2012, p. 141) and Pickard (2007, p. 75).

The following factors were of chief concern:

- **Confidentiality and Anonymity**: Appropriate measures to ensure anonymity and the potential limits of confidentiality were discussed with interviewees prior to interviews. Interview notes were typed up and stored securely on password-protected computers, while the online survey collected encrypted data securely and anonymously, compliant with ISO27001 (Snap Surveys Ltd, 2015a). The user email list used to send out survey links via mail merge was deleted following the closure of the survey, and response data was kept in accordance with the Data Protection Act (1998), and only for as long as required for the purposes of the study.
- **Informed Consent**: For both the interviews and the survey, respondents were provided with introductory information related to the purpose of the research, what the research was about, who was undertaking it, and how the results were to be used. The right to withdraw from the interview was highlighted, and the right to refuse to participate in the survey was taken as implicit in the nature of online surveys. Interviewees were debriefed following the interviews, and notes taken during the interview were typed up in Microsoft Word and sent to the participant for checking and corroboration. While this was not possible with the online survey, the researcher's contact details were indicated at the close of the survey for respondents who required further information.

In addition, the NHS Health Research Authority (HRA) online decision tool (n.d.) was consulted to check whether the study required a Research Ethics Committee review; the tool indicated that – since the study was a *service evaluation* rather than clinical research (HRA, 2013) – an ethical review was not required. This was subsequently confirmed by the Trust's Research & Development (R&D) department (personal communication, August 2015).

Having received this confirmation from the local R&D department, the data collection for this study was able to proceed. Both the interviews and the online survey took place over a period of a month; the next chapter analyses the results.

Chapter 4: Results

This chapter presents the results of the stakeholder interviews and CV survey. Following an analysis of the WTP amounts, and aggregating a WTP amount for the population, the ROI for the library's out-of-hours access service will be calculated.

4.1 Stakeholder Interviews

The purpose of the stakeholder interviews was to gather qualitative data regarding the value of the library, particularly economic value and ROI, and achieve some insight into the wider context of organisational objectives in line with best practice recommendations identified in the literature review (for example Luther, 2008; Strouse, 2003; Tenopir, 2012).

Using a combination of convenience and snowballing sampling approaches, six individuals were identified as potential interviewees. The drawbacks of the snowball sampling technique, such as the danger of over-saturation (Pickard, 2007, p. 65), were noted, and it was recognised that this would result in a non-probability sample, and the findings could not therefore be generalised (Bryman, 2012, p. 201); however, it was felt to be an appropriate approach in order to generate a qualitative contextual background to the main CV study.

4.1.1 Findings

Only three of the selected interviewees consented to be interviewed, potentially limiting the study since none of the contacts from the finance department responded; nevertheless, the three interviews provided useful information from a range of senior management perspectives. These perspectives may be characterised as follows:

Interviewee 1	Information Management & Technology – this directorate is strategically linked to the library through the line management structure
Interviewee 2	Postgraduate Education Centre – closely linked to the library in relation to resources for medical trainees
Interviewee 3	Clinical Learning Environment for student nurses and midwives – also linked through resources

Table 6: Interviewee Perspectives

Through the use of the semi-structured interview design, with a standard set of questions (Appendix C) but nevertheless some leeway in how they could reply (Bryman, 2012, p. 471), the interviewee's responses were analysed in line with grounded theory. This is an inductive framework widely used for analysing qualitative date (Bryman, 2012, p. 567), which starts with the research question and works towards developing theory, through sampling and the construction of data categories (Pickard, 2007, p. 157). Despite the small number of responses, the key process of coding, "whereby data are broken down into component parts, which are given names" (Bryman, 2012, p. 568), was deemed a useful approach to analysing the interview responses and identifying the key themes.

4.1.2 Qualitative Analysis

While Pickard describes three distinct activities in the coding process - open coding, axial coding and selective coding (2007, p. 242) - for the purposes of this analysis it was sufficient to deconstruct the data using an open coding approach, where similarities in the data "will lead eventually to concepts … being labelled with the same name thereby creating a category" (Pickard, 2007, p. 243). In relation to the three interviews conducted, the following themes emerged:

Themes	Comments
Economic Necessity	All three interviewees identified the need to demonstrate economic value, given the current economic climate. Interviewee 1 stated that "in this climate of financial constraint, everything has to be justified," while interviewee 2 called it "critical" and highlighted the "need to demonstrate to the Chief Executive good value for money." Interviewee 3 noted that "everyone is under the microscope."
Practical Difficulties	Given the need to demonstrate economic value, there was agreement that this was not so easy in practice. Interviewee 3 said that ROI would be "very difficult to calculate, nigh on impossible", and interviewee 1 cautioned that "you have to be quite careful about not claiming more than you can demonstrate" and that any financial claims "have to be transparent, and not just quantifiable but realistic."
National Targets	The importance of demonstrating support for national targets, in alignment with Trust objectives, was highlighted by the interviewees. Interviewee 2 explained that "reports from external monitors have

	meaning for the Trust", such as the General Medical Council (GMC) survey results from medical trainees, while Interviewee 3 cited CQUINs (the Commissioning for Quality and Innovation payment framework), asking "what services does the library provide that supports this?" Interviewee 1, meanwhile, had some useful insights into the use of dashboards and scorecards for the presentation of data in the Trust: they are "fine once everyone understands what they are saying … can be useful for benchmarking and external purposes," however they "may give a false sense of security … just a snapshot with no context."
Risk Avoidance	Interviewee 1 asked "if [the library] didn't exist, what would the Trust do and how much would it cost?" This was echoed by interviewee 2, who asked "what is the risk of not having access to up to date information? … If you got rid of the library, how would that affect [the Trust's] credibility to external organisations?" It was clearly felt by all interviewees that the library plays a fundamental role in supporting the Trust's teaching and learning activities - according to interviewee 3, for example, "the library is a huge part of the educational support provided to staff" – and that there was a definite risk associated with not having a library. According to interviewee 1, "in terms of training junior doctors, an onsite library with appropriate resources to support them are a requirement; if the library wasn't there, what impact would this have on placements and the quality of training?"
Patient Safety	In terms of question 6, which asked about other types of value that the library might seek to demonstrate, patient care and safety was mentioned on numerous occasions. Interviewee 3 cited several key areas such as reduced length of stay, reduced morbidity, and increasing positive outcomes for patients, although it was conceded that it was difficult to quantify the library's impact in these areas. Time saved by clinicians was also mentioned as ultimately benefitting patients, with interviewee 2 giving the example of convenient access to information for clinicians leading to "avoiding unnecessary tests and investigations". Interviewee 1 also suggested that "it's useful to think in currencies other than money; for example, materials and staff – how many beds, consultants, or porters

	does [the library] equate to?"
The CV Method	Interviewee 2 found the CV method "too obscure and too complicated", while the other interviewees were more cautious: interviewee 3 thought that it would depend on "how you did it, what you asked, and what was being valued"; interviewee 1 thought "it may be useful as part of an overall approach to demonstrating value" and raised the crucial point that "users often don't know how much things cost … especially for services that are free at the point of contact."

Table 7: Interview Themes

4.2 The Contingent Valuation Survey

In their guidance on using stated preference techniques for economic valuations, Pearce and Ozdemiroglu highlight two objectives in the analysis of WTP data:

1. Estimating the mean and median WTP amounts for the sample, with confidence intervals (2002, p. 63)
2. Testing validity by looking to see if "responses have a distinguishable structure and conform to prior expectations and economic theory" (2002, p. 63) and "whether the differences in responses can be explained through differences in the characteristics of the respondents" (2002, p. 64)

This validity test is routinely done using regression analysis (see for example Fujiwara et al., 2015; Hajek & Stejskal, 2014; Hider, 2008; Whynes & Sach, 2007; Yen et al., 2007), which is "a complex statistical task … [that] will require professional advice from econometricians" (Pearce & Ozdemiroglu, 2002, p. 63). Given the limited scope of this study, it is inevitable therefore that such professional advice is unavailable, along with sophisticated statistical software; nevertheless, it will be sufficient to attempt a simplified regression analysis of the data, outlining any assumptions made and other limitations in order to inform future studies in this area.

Firstly, however, a summary of descriptive statistical information about the survey responses is provided.

4.2.1 Findings

Response Rate

An initial random sample (n=73) was identified from the population of all library users with an access card on loan (N=305), to ensure a 95% confidence level with confidence interval 10. Due to a poor response rate of less than 20%, however, the online survey was redistributed to the remainder of the population. The following table summarises the two stages:

	Population (N)	**Sample (n)**	**Undelivered**	**Responses**	**Response Rate**
Stage 1	305	73	3	13	18.57%
Stage 2	305	232	5	33	14.53%
Overall	**305**	**305**	**8**	**46**	**15.49%**

Table 8: Online survey response summary

Job Categories

For question 1, users were asked to select the category best describing their job role. The following chart summarises the user category responses:

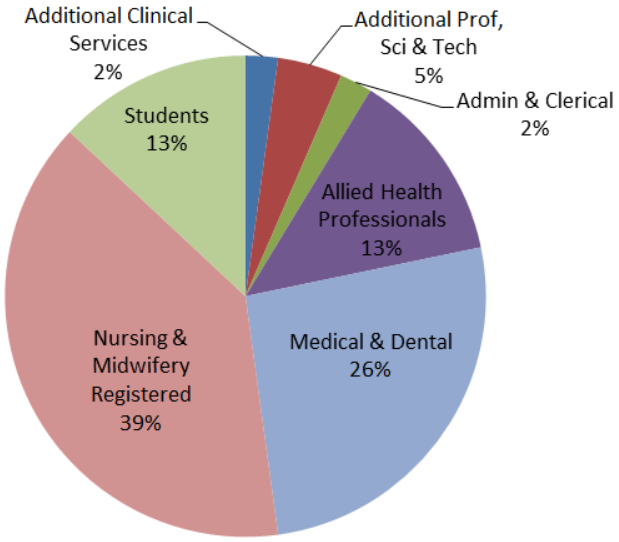

Figure 2: Pie Chart of Responses by Job Category

These categories are the same as those used in the library management system, to facilitate a comparison between response and population categories:

	Population		Respondents	
Job Category	**Number**	**%**	**Number**	**%**
Additional Clinical Services	34	11.15	1	2.17
Additional Professional, Scientific & Technical	14	4.59	2	4.35
Administrative & Clerical	10	3.28	1	2.17
Allied Health Professionals	7	2.30	6	13.04
Estates & Ancillary	1	0.33	0	0.00
Healthcare Scientists	3	0.98	0	0.00
Medical & Dental	76	24.92	12	26.09
Nursing & Midwifery Registered	136	44.59	18	39.13
Students	24	7.87	6	13.04
Total	**305**	**100**	**46**	**100**

Table 9: Job Categories – Population and Responses

It can be seen that there are some proportional similarities, for example in the two largest categories (*Medical & Dental* and *Nursing & Midwifery Registered*); however some categories demonstrate a much lower or higher response rate than expected (*Additional Clinical Services* and *Allied Health Professionals* respectively), and this will be taken into account through the use of analytical weights when aggregating the population WTP amount.

Access Card Usage

The majority of users (61%) have had an access card for longer than six months (Q2), with all but two of the respondents having used the card since borrowing it (Q5). Most respondents (34%) use their card one or two times a month, although 48% use it between 3 and 10 times a month:

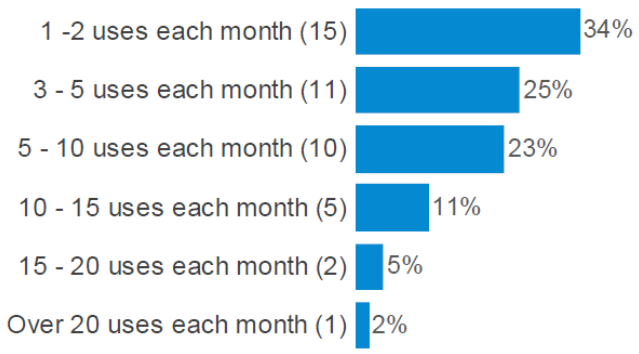

Figure 3: Access Card Usage (Q5a)

Most users (70%) spend between 1 and 4 hours on an average visit to the library out of hours (Q5b), and their reasons for using it (Q5c) are primarily as a quiet place to study (93%), and to access books and journals (73%), computers (64%) and the photocopier/printer/scanner (55%).

The majority of respondents use the library in relation to education and training (93%); however, a significant proportion (55%) also indicated that their activities were related to patient care:

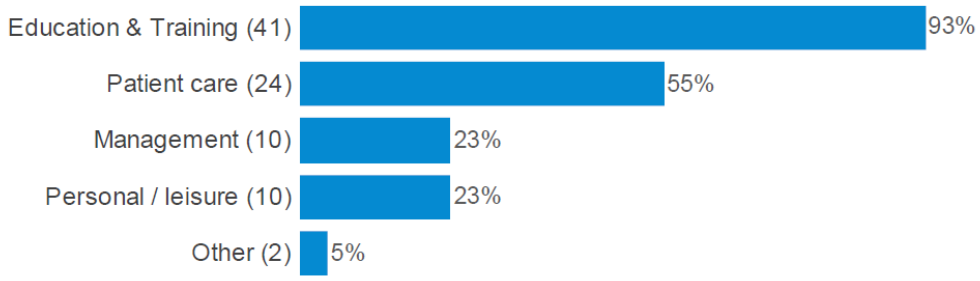

Figure 4: Areas related to use of the library (Question 5d)

Overall Satisfaction

80% of respondents stated that they were *Very Satisfied* with the out-of-hours service and 15% were *Satisfied* (Q6), while the majority (98%) indicated that they would be either somewhat or severely affected if the service was not available (Q7). Question 8 asked for open-ended feedback on the service, and an overall positive response was received, for example:

> *"I used the out-of-hours library service whilst undertaking my nurse prescribing course and it was an invaluable service. The course was very intensive and I sometimes used the library until nearly midnight and over the weekend. It's an excellent service."*
> *"I think the service is invaluable… great for quiet study …"*
> *"I am a doctor working in the A&E. It helps having out of hours access as we might be working different hours through the week … It's most helpful to log into Trust computers for info and journals."*
> *"Really useful to be able to access books in the evenings and weekends."*
> *"Excellent service and much needed for staff who work various unsocial shifts."*

"If I had not had access to the library at the weekends, I would have struggled to complete my management course. It's a fantastic environment to concentrate and study."

This section was also useful for flagging up various issues which can be addressed by the library, such as suggestions for more books in a particular section, a fault with the security alarm system, and problems with parking.

Other questions in the survey, such as the conditional questions following question 5c on the use of computers and the printer, will provide data for the calculation of service costs; questions 3 (How close do you live to the library?) and 4 (Pay band) were specifically designed as comparative variables for the regression analysis of the WTP responses.

4.2.2 Willingness-to-Pay (WTP) Estimates

As discussed in chapter 3, question 9 is a *dissonance minimising* question designed to minimise various types of bias. Of the 46 survey respondents, 22 indicated that they would be prepared to make an annual payment, and therefore only these respondents were routed to the WTP question itself, and all the other responses, in line with established practice in other studies (for example Borghi, 2008; Carson, 2012; Fujiwara et al., 2015), are conservatively treated as zero WTP amounts. In addition, question 9b asked how certain the respondents were about their stated WTP; 19 (91% of those who answered) stated that they were "very certain" and only these responses are used in the mean WTP calculation, while the three "somewhat certain" or blank responses are again treated as WTP estimates of £0.

Therefore, having counted 27 responses as zero WTP amounts, the 46 WTP estimates were as follows:

WTP Amount	Frequency	%
£0.00	27	58.70%
£2.00	1	2.17%
£5.00	2	4.35%
£10.00	6	13.04%
£12.50	1	2.17%
£15.00	2	4.35%
£20.00	6	13.04%
£25.00	1	2.17%
Total	**46**	**100.00%**

Table 10: WTP Responses

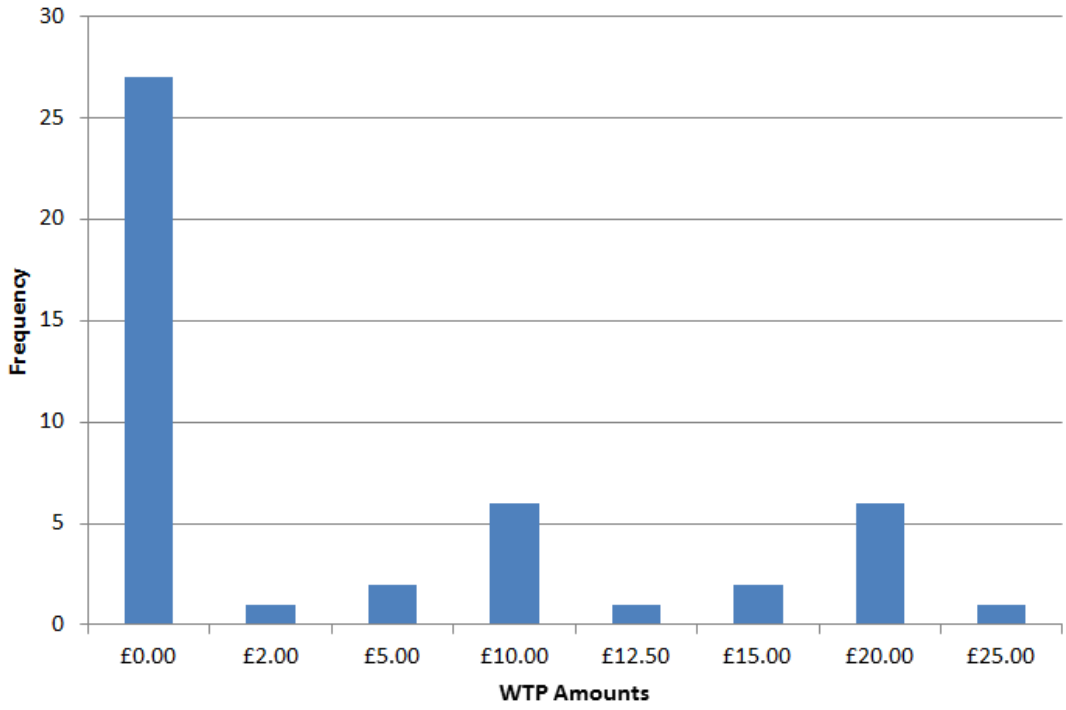

Figure 5: Bar Chart of WTP Amounts

In their analysis of payment card data, Fujiwara et al. calculate the mean and median WTP from the mid-point between the amount chosen and the next amount (2015); for the purposes of this study, however, the WTP responses given will conservatively be taken as respondents' maximum WTP amounts..

In order to estimate the mean and median WTP, Pearce and Ozdemiroglu recommend the use of non-parametric estimation techniques, such as Turnbull's Self-Consistency algorithm for interval data (2002, p. 69); such techniques are beyond the scope of this study, however, so

the arithmetic mean has been calculated according to the standard formula (Pickard, 2007, p. 256):

$$\text{Mean (M)} = \frac{\text{Total of all values}}{\text{Number of cases}}$$

Therefore

$$M = \frac{2 + (2x5) + (6x10) + 12.5 + (2x15) + (6x20) + 25}{46}$$

$$M = £5.64$$

However, Pickard notes that the mean can be misleading if the distribution is skewed and there are atypically high or low values (2007, p. 256); given the high number of zero responses it is likely that this distribution of WTP values is skewed to the left, and the mean value therefore uncharacteristic of the sample.

This is confirmed by the bar chart above (Figure 5), and also by looking at the standard deviation, which is calculated to be $\sigma = 7.918$ (Table 11) and therefore would result in a negative WTP value if one considers the value two standard deviations below the mean (-£10.20), since two standard deviations below or above the mean are usually required to assume the results are typical of the population (Pickard, 2007, p. 261). For strongly skewed distributions, it is possible to apply common statistical techniques to the logarithm of the original variable, since the logarithm itself will have a normal distribution (Smith, 2012, para 9), but once again this is beyond the scope of this study.

With regard to the median of the WTP values: intuitively, if there are 27 £0 responses, then the median itself will be £0. While this may be more representative than the mean for skewed data (Pickard, 2007, p. 257), it is still not truly characteristic measure of central tendency because its value is not influenced by any other WTP values.

Other summary descriptive statistics for the WTP amounts, calculated with Excel, are tabulated below:

Mean	5.6413
Standard Error	1.16746
Median	0
Mode	0
Standard Deviation	7.9181
Sample Variance	62.6963
Kurtosis	-0.3508
Skewness	1.05669
Range	25
Minimum	0
Maximum	25
Sum	259.5
Count	46
Confidence Level (95.0%)	2.35138

Table 11: WTP Amount Summary Statistics

Along with estimates for the mean and median, Pearce and Ozdemiroglu highlight the requirement for "the construction of a 95% confidence interval" (2002, p. 70) to give an indication of the accuracy of these estimates. For non-parametric samples, they recommend the "bootstrapping" technique; this is a very robust method for calculating confidence intervals, where the original sample is resampled thousands of times (Pezzullo, 2015, para 7). The technique was therefore applied using the free software *Statistics101* (Statistics101, 2015), and after 100,000 resamples, the 95% confidence interval was found to be between 3.467 and 7.989. In other words, there is a 95% chance that the sample mean WTP will fall between £3.47 and £7.99, and in fact this supports the mean WTP value found above, especially when the histogram of 100,000 sample means generated is viewed:

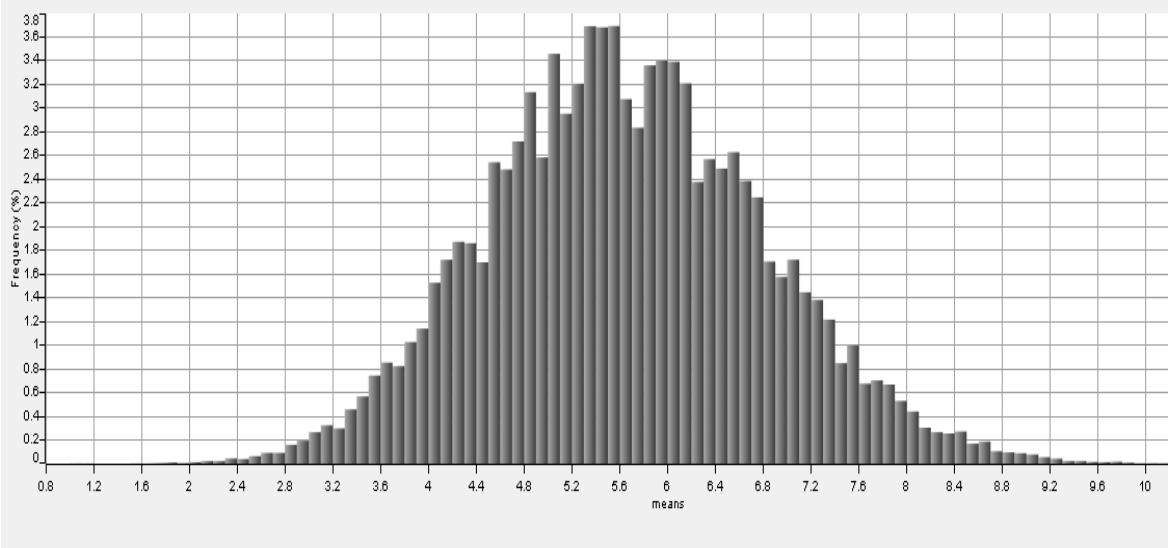

Figure 6: Bootstrap Mean Frequency Distribution

It can be seen here that the centre of the bootstrap mean distribution is around 5.4 - 5.6. The Statistics101 programme used to generate the histogram and confidence interval was based on an example in Grosberg (2015, p. 42) and can be found in Appendix E.

4.2.3 Regression Analysis

Regression analysis is "a statistical tool for the investigation of relationships between variables" (Sykes, 1993, p. 1), and in the context of CV, a way of testing the construct validity of WTP responses by looking at their relationship to other theoretically relevant variables (Fujiwara et al., 2015, p. 23). Typically the most relevant variable is related to respondents' income (Mitchell & Carson, 1989, p. 174), although Pearce and Ozdemiroglu also list proximity to the site, and the respondents' current knowledge about the good or service in question (2002, p. 71).

In simple terms, linear regression is used to identify the line of best fit between two variables, in order to examine the correlation between them. It works by repeatedly moving the line (in the form y=a+bx) and squaring the difference between the estimated y value – sometimes labelled y' (Stephen & Hornby, 1995, p. 144) - and the true y value of the observation. The line of best fit occurs when the sum of the squares of these estimated errors is at a minimum (Sykes, 1993, p. 7).

While it is possible to undertake a simple linear regression to examine the relationship between a dependent variable and an independent variable, it is often advisable to consider

additional variables in order to avoid "omitted variables bias" (Sykes, 1993, p. 25). For the current study, the following independent variables – particularly those variables which might be expected to have an impact on WTP - were used in the analysis (layout modelled on Fujiwara et al., 2015, p. 18-21):

Independent Variable	**Description**
Distance to library	Likert scale 1-3 where 1=More than 5 miles and 3=Less than a mile
Pay Band	Ranked by pay band (2-9, where 8 and 9 are used instead of 8a and 8b)
Frequency of use	Likert scale 1-6 where 1=1-2 uses each month and 6=Over 20 uses each month
Duration - time spent in library	Likert scale 1-5 where 1=Less than one hour and 5=Over 6 hours
Overall satisfaction	Likert scale 1-5 where 1=Very dissatisfied and 5=Very satisfied
Extent that work would be affected by lack of access	Likert scale 1-3 where 1=Unaffected and 3=Severely affected

Table 12: Regression Variables

Respondents who preferred not to give answers to some of these questions (such as pay band details) have also been excluded from the analysis. The total number of observations in the analysis was therefore 35.

The survey data was re-tabulated in Excel using the Likert scale values (see Appendix F), and looking at the resulting scatter graphs for some of these variables against WTP, the difficulties of identifying a line of best fit become apparent:

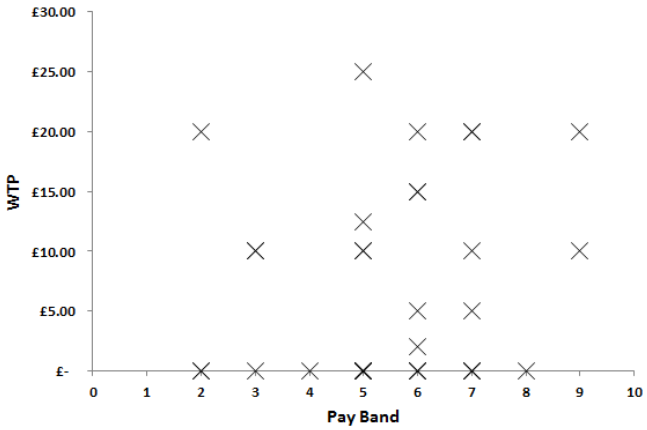

Figure 7: Scatter Graph – WTP and Pay Band

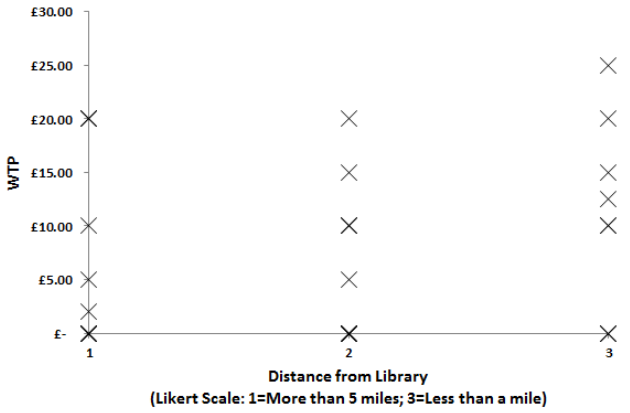

Figure 8: Scatter Graph – WTP and Distance from Library

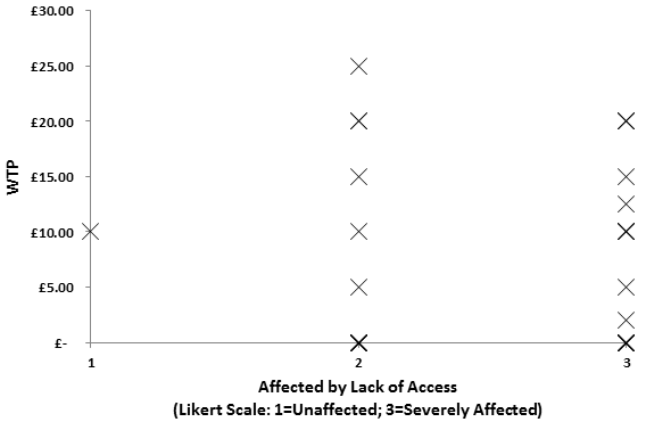

Figure 9: Scatter Graph - WTP and Extent Work Affected by Lack of Access

Regression analysis provides an effective mathematical tool for calculating the line of best fit, and for this study, the *Excel Regression Analysis* function was used. Cameron notes that Excel assumes the standard error around the mean is *homoscedastic* (2009, para 41); in other words, the variance around the regression line is the same for all true values of an independent variable (Statistics Solutions, 2013, para 1). A normal distribution is also assumed for multiple regression where there are multiple independent variables (Statistics Solutions, 2015b, para 6); therefore, if the distribution is skewed, the regression output may be inaccurate and a more advanced technique such as *logistic regression* may be required (Statistics Solutions, 2015a). The free statistical analysis software *PSPP* (Free Software Foundation, 2015) was explored to see if such techniques were available; however, only the multiple regression analysis could be found and the results (see Appendix G) were the same as the Excel analysis output:

Multiple R	0.2257
R Square	0.05094
Adjusted R Square	-0.1524
Standard Error	8.72589
Observations	35

Table 13: Excel Regression Analysis Output (1)

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2.077	14.091	0.147	0.884	-26.787	30.941
Distance	1.700	1.947	0.873	0.390	-2.288	5.689
Pay Band	0.667	0.859	0.776	0.444	-1.093	2.426
Frequency	-0.394	1.410	-0.280	0.782	-3.282	2.493
Duration	-0.089	1.109	-0.081	0.936	-2.361	2.182
Satisfaction	-0.560	2.184	-0.256	0.800	-5.033	3.914
Affected	0.710	3.548	0.200	0.843	-6.558	7.978

Table 14: Excel Regression Analysis Output (2)

Table 13 gives the "overall goodness-of-fit measures" (Cameron, 2009, para 13). *Multiple R* is the correlation coefficient, indicating the strength of the correlation where 1 means a perfect positive correlation (Andale, 2015, para 2); in this case, multiple R is 0.23, suggesting a weak positive relationship overall. *R Square* (or R^2) is the "measure of the extent to which the total variation of the dependent variable is explained by the regression" (Sykes, 1993, p. 23), and a value here of 0.05 suggests that only around 5% of the variation in WTP amounts can be explained by the regression analysis (Dietz & Kalof, 2009, p. 487).

The *Adjusted R Square* value is used as "a diagnostic when we are adding new variables to a model" (Dietz & Kalof, 2009, p. 500), specifically to see its impact on the R^2 value. For example, if a *Certainty* variable is introduced to the regression analysis (where 1=very certain; 0=otherwise), where one would expect a much stronger positive correlation with WTP, due to the context of the certainty question (Q10), Multiple R increases to 0.77 and R^2 to 0.59.

Table 14 displays the calculated coefficients for each independent variable. As defined by Fujiwara et al. (2015, p. 23), the magnitude of the association between WTP and the independent variable is represented by this coefficient; the statistical significance is demonstrated by the *t-statistic*, which is the coefficient divided by the standard error (Cameron, 2009, para 25), and specifically the *p-value*, which needs to be less than a probability of 0.05 in order to reject the null hypothesis that there is no correlation with a 95% confidence level (Cameron, 2009, para 25).

While it can be seen that some of the variables (*Distance*, *Pay Band* and *Affected*) have coefficients which indicate a positive relationship with WTP, none of them are statistically significant at the required $p<0.05$, so the null hypothesis cannot be rejected for any of the independent variables. Therefore, possibly due to the high number of zero WTP amounts and the low response rate, the validity of the CV survey data cannot be sufficiently established, and it is not possible to say that the WTP amounts are *not* purely random (Pearce & Ozdemiroglu, 2002, p. 72).

4.2.4 Aggregating WTP for the Population

Despite being unable to establish sufficient analytical validity for the WTP data, the WTP data will still be used to calculate an ROI figure for the out-of-hours access service, in order to demonstrate the process and provide an insight into the application of the CV methodology.

The next step is therefore to calculate an aggregated WTP amount for the whole population, and since the low response rate is likely to have resulted in biased and non-probabilistic findings (Bryman, 2012, p. 200), Pearce and Ozdemiroglu advise the use of analytical weights to improve the representativeness of the sample (2002, p. 66).

These analytical weights are defined according to a particular characteristic grouping of the population (Pearce & Ozdemiroglu, 2002, p. 90); in this instance, *job category* was chosen,

since it was evident from the comparison between population and sample job category proportions (Table 9) that there were some discrepancies between the two.

The weights for each job category are calculated by dividing the proportion of the population in that category by the proportion of the sample, and the weighted WTP amounts are derived by multiplying the total WTP for each category by the analytical weight:

Job Category	**Population %**	**Sample %**	**Total WTP**	**Analytical Weight**	**Weighted WTP**
Additional Clinical Services	11.15	2.17	£20.00	5.14	£102.80
Additional Professional, Scientific & Technical	4.59	4.35	£0.00	1.06	£0.00
Administrative & Clerical	3.28	2.17	£0.00	1.51	£0.00
Allied Health Professionals	2.30	13.04	£5.00	0.77	£3.85
Estates & Ancillary	0.33	0.00	£0.00	N/A	£0.00
Healthcare Scientists	0.98	0.00	£0.00	N/A	£0.00
Medical & Dental	24.92	26.09	£85.00	0.96	£81.60
Nursing & Midwifery Registered	44.59	39.13	£124.50	1.14	£141.93
Students	7.87	13.04	£25.00	0.60	£15.00

Table 15: Analytical Weights

The total weighted WTP amount can then be used to calculate a weighted sample mean ($\hat{M}$):

$$\hat{M} = \frac{£345.18}{46} = £7.50$$

If N is the total number of individuals in the population, then using Pearce and Ozdemiroglu's formula (2002, p. 90):

$$\text{Aggregate WTP} = N \times \hat{M}$$
$$= 305 \times £7.50$$
$$= £2,287.50$$

Therefore, the total estimated WTP amount for the out-of-hours access service for one year is £2,287.50.

4.3 Calculating the Return on Investment

Having used the CV method to estimate a monetary value which can be assigned to the estimated benefits of the out-of-hours access service, the next step is to consider the total costs of the service, before combining them all into the ROI calculation.

Since the access card system was installed in April 2013, this calculation will include the costs and benefits over a three-year period, covering the financial years 2013-14, 2014-15 and 2015-16.

4.3.1 Service Costs

When calculating the total cost of the service, it is essential to consider not just the implementation costs of the access card system, but also the variable costs in relation to staff time and the use of consumables such as power used by computers and printing, and printer paper and toner. The calculation is therefore broken down into three parts - system costs, administration costs, and consumable costs – and tabulated below for the three-year period. Full calculations can be found in Appendix H.

System Costs	
Installation (including delivery)	£4,975.20
Access cards x 200	£870.00
Access cards x 200	£870.00
Sub-Total:	**£6,715.20**
Administration Costs	
Issuing/renewing access cards	£976.76
Overdue reminders	£85.40
Access card deposits (retained)	-£2,160.00
Sub-Total:	**-£1,097.84**
Consumable Costs	
Use of computers	£425.97
Use of printer/photocopier	£508.03
Sub-Total:	**£934.00**
Total Service Costs:	**£6,551.36**

Table 16: Service Costs

The cost calculations make the following assumptions:

- Costs include VAT were possible.
- An equivalent population (N=305) borrowed a card in previous years.
- Total staff time required for each card borrowed is 5 minutes, taken up with issuing the card, showing the user how to use the card, and either renewing the card or returning it. A small fraction of the time is also assumed to include the task of having ordered the card.
- Transactions are carried out by a full-time Library Assistant, on the mid-point of the Band 3 pay scale. The current 2015 NHS Agenda for Change pay scales were used (NHS Employers, 2015) and entered into an online "hourly rate" calculator available via the NHS Library & Knowledge Services Wiki (2015), which includes on-costs, annual leave entitlement, and other factors in its calculation.
- Each overdue email takes approximately 2 minutes to generate.
- Data for computer and printer/photocopier usage was derived from the CV survey responses (Q5a, Q5c.1, Q5c.2), and the mid-point of the variable intervals were used

(for example, 1-2 visits per month was averaged out as 1.5); open-ended responses - "over 6 hours" and "over 20 pages" - were set at 8 and 30 respectively.

- The cost of electricity and the power required to run the computers are based on calculations by the University of London, Birkbeck in 2014 for similar desktop computers (BBK, 2014).
- All 17 library computers are assumed to be in an idle state during evenings and weekends, unless they are being actively used.
- Although the printer is a multi-function device, enabling scanning as well as printing/photocopying, it is assumed that all uses are either printing or photocopying in order to fully load the cost of paper and toner.
- The power required to run the printer/photocopier in both active and idle states is taken from *EnergyUseCalculator.com* (2015).
- A4 paper costs are based on previous library purchase orders.
- The average cost of toner, including VAT, for the particular model in the library – a Xerox Work Centre 6400 – is taken from *Xerox.co.uk* (2015).
- The cost of heating and lighting is not included. These overheads are paid for centrally by the organisation and not included in the library's budget statement, and it is therefore difficult to estimate the effect of out-of-hours access.

4.3.2 ROI Calculation

Having established the service costs above and the aggregated WTP amount for the three-year period (3 x £2,287.50 = £6,862.50), it is now possible to return to the ROI formula seen in chapter 2:

$$\text{ROI} = \frac{(\text{Gain from investment} - \text{Cost of investment})}{\text{Cost of investment}} \times 100\%$$

Entering the costs and gain in the form of WTP:

$$\text{ROI} = \frac{£6{,}862.50 - £6{,}551.36}{£6{,}551.36} \times 100\%$$

$$= 4.75\%$$

So the return on investment from the library's out-of-hours access service from 2013 to 2016 is 4.75%.

In terms of the cost-benefit ratio (CBR):

$$\text{CBR} = \frac{\text{Gain from investment}}{\text{Cost of investment}}$$

$$= \frac{£6{,}862.50}{£6{,}551.36}$$

$$= 1.0475$$

Therefore the cost-benefit ratio is 1 : 1.0475, and it can be said that for every £1 invested in the out-of-hours access service, there is a benefit approximately equivalent to £1.05.

The next chapter will consider the findings from the literature review, the stakeholder interviews, and the CV survey, and discuss the implications and limitations of both the research and the CV method. This will provide useful insights and recommendations for future work and research, particularly in the area of ROI for NHS libraries in England.

Chapter 5: Discussion

The previous chapter examined in detail the findings of the stakeholder interviews and the contingent valuation survey, and the data related to WTP amounts were analysed for validity and aggregated to the population; this was then used in conjunction with service costs to calculate the return on investment for the library's out-of-hours access service, resulting in a figure of 4.75% over the three years since implementation. The present chapter will discuss the implications of the methodology and findings, along with associated assumptions, limitations, and finally recommendations for future studies.

5.1 Aims and Objectives

The aim of this study was to calculate the return on investment (ROI) for the out-of-hours access service at Wexham Park Hospital library, using the contingent valuation (CV) method. This aim has been met within the scope of the study; the ROI has been estimated as 4.75%, based on the responses to a CV survey.

Therefore the primary objective, which was to develop and implement a CV survey to elicit library users' willingness-to-pay (WTP) for out-of-hours access to the library, has also been met. The survey was designed and implemented according to best practice as described in the literature, using the payment card elicitation method and various techniques, such as dissonance minimizing, cheap talk, and a certainty question, to minimise bias. The survey data were then subjected to regression analysis, as recommended in the literature, to attempt to establish the construct validity of the WTP responses.

Secondary objectives of the study were:

- to use the aggregated WTP value as part of a cost-benefit analysis and ROI calculation
- to evaluate the validity of the CV method in the context of NHS library services

This first secondary objective was met; the aggregated WTP amount of £2,287.50 for one year of out-of-hours access was calculated using weighted means, and subsequently used in the ROI and cost-benefit ratio calculations.

In terms of evaluating the validity of the CV method itself; the literature review clearly established CV as a potentially useful method of evaluating public sector goods and services (Ashley & Niblett, 2014; Ko et al., 2012; Mitchell & Carson, 1989, p. 2), with an advantage over other methods commonly used in ROI evaluations, such as time saved and cost avoidance methods, in that it is based on stated preferences rather than inferences (Matthews, 2007, p. 304), and tends to result in more conservative, and therefore more credible, WTP estimates (Aabø, 2009; Fujiwara et al., 2015; McIntosh, 2013).

However, there are drawbacks to the use of CV; a range of biases are associated with the method and the various elicitation techniques it employs, such as hypothetical bias (Hausman, 2012; Levin, Driscoll & Fleeter, 2006), strategic bias and protest bidding (Fujiwara et al., 2014), and anchoring bias (McIntosh, 2013). In addition, it can be a very complex process to ensure credibility and validity (Ashley & Niblett, 2014), with the statistical analysis alone usually requiring professional advice from economic experts (Pearce & Ozdemiroglu, 2002, p. 63). This can make it very expensive and time consuming to implement (Kim, 2011; Missingham, 2005).

Nevertheless, assuming steps are taken to minimise potential bias where possible – for example, by using dissonance minimising and cheap talk (Hider, 2008) – and appropriate resources are available, CV can be viewed as a reliable method for estimating the economic value of public sector services (Carson, 2012; Ko et al., 2012), yielding more conservative estimates than other methods, such as cost avoidance (McIntosh, 2013). In the context of NHS health libraries, therefore, and future attempts to examine the return on investment of NHS libraries as proposed in *Knowledge for Healthcare* (HEE, 2015), the application of the CV method should be considered a viable evaluation approach.

5.2 The CV Survey

In the current study, the CV survey was designed to include a number of mechanisms for reducing bias. Dissonance minimising (Q9) gave respondents the option to support the service without agreeing to make a payment, and the certainty question (Q10) provided a further control, giving respondents the opportunity to express any further doubts about their stated WTP amount. The fact that 91% of respondents who did express a WTP amount were "very certain" that they would pay it suggests that the dissonance minimising approach acted as an effective filter for reducing yea-saying and providing very reliable estimates; in addition, the lack of stated £0 or unrealistically high WTP estimates implies a lack of protest

bidding or strategic bias. However, it is difficult to determine whether the payment card approach has resulted in any associated range bias, and some element of anchoring bias - due to the current deposit of £10 - may be present, although just as many respondents selected £20 as £10. If possible, future CV studies might therefore consider alternate elicitation methods, perhaps combining closed and open-ended formats (Hajek & Stejskal, 2014), or introducing a random element to the payment card method (Shackley & Dixon, 2014).

The conservative nature of the CV method, meanwhile, was ensured by the standard practice (Carson, 2012; Fujiwara et al., 2015) of assigning a £0 WTP value to responses that indicated a "no" or "don't know" to question 9, and "somewhat certain" to question 10. As a result, 27 responses (58.7% of the sample) were considered to be £0 WTP responses, a figure that impacted on the subsequent sample mean and aggregated WTP estimates.

The sample size itself was problematic, with an element of sampling bias due to the high level of non-responses, resulting in a non-random sample which failed to reach the required figure (n=73) for a 95% confidence level with confidence interval 10. However, this problem affects surveys of all kinds (Bryman, 2012, p. 199), and is not unique to CV surveys, and attempts were made through the application of the bootstrapping technique and analytical weights to improve the mean estimate and the representativeness of the sample.

A more serious limitation resides in the inability to establish sufficient validity for the WTP data by means of the regression analysis. It is likely that the small sample size and high level of £0 WTP amounts were a factor, and although the coefficients for several independent variables (*Distance*, *Pay Band* and *Affected*) were suggestive of the type of positive correlation with WTP amounts that one would expect from a theoretical perspective, the statistical significance could not be established, and the null hypothesis could not be rejected. Ultimately, therefore, it was not possible to say that statistically the correlation with WTP did not arise by chance. In addition, the non-parametric distribution may require the application of more advanced regression models beyond the scope of this study, and future research with CV surveys should take into account the need for complex and specialised analytical techniques in order to establish validity.

It should also be noted that, due to the scale of the study, the CV survey sample and population did not include non-users of the out-of-hours access service, either from the entire population of registered library members or the wider population of Trust staff; the final ROI

figure therefore may represent an under-estimation of the true value placed on the out-of-hours service, given that *option value* (Harless & Allen, 1999, p. 56) has not been included.

5.3 Return on Investment

The literature review demonstrated that ROI for libraries is an area of considerable research over the last two decades, primarily motivated by the need to demonstrate economic value (Balas, 2011; Huwe, 2011). Key ROI studies have emerged from the public library sector in the United States (Barron et al., 2005; Griffiths et al., 2004; Holt et al., 1999), Britain (Fujiwara et al., 2015; Jura Consultants, 2005), and other countries such as Australia (Hider, 2008), South Korea (Ko et al., 2012), and Norway (Aabø, 2005).

Academic libraries are have also contributed significantly to ROI research; a study by the University of Illinois, Urbana-Champaign (UIUC) in particular has proved influential (Luther, 2008). So too has a British Library study (Pung et al., 2004) in the field of national libraries.

In the context of health libraries, ROI has been less studied but is now increasingly seen as important; further to work by ALIA's report on health libraries (2013), NHS libraries in England are preparing to undertake research into ROI (HEE, 2015).

But there are concerns about the ROI approach to library evaluation: there is a distinct lack of consistency in methodology (Aabø, 2009), with a diverse range of techniques such as cost avoidance, time saved, and contingent valuation, as well as differences in terminology and data collection methods (Cullen, 2003), leading to flawed ROI figures which are vague and easily manipulated (Neal, 2011). This issue with credibility needs to be addressed through the use of comprehensive operating standards, such as those proposed by Philips and Philips (2007), alongside close alignment with the strategic objectives of the wider organisation (Hendriks & Wooler, 2006), and an understanding that ROI is just one of range of tools to be used for demonstrating library value (Lown & Davis, 2009).

These points are clearly echoed by the responses from the stakeholder interviews conducted for this study. While all the interviewees agreed that there was a need to demonstrate economic value, a clear theme to emerge was the need for the library to demonstrate its contribution to and alignment with organisational objectives in relation to national targets and initiatives. Furthermore, while it was accepted that ROI and the CV method may be useful as part of an overall approach, it was thought to be very difficult to apply in practice, and there

are other areas, such as the library's contribution to patient safety, to be considered as equally – if not more - important.

In terms of the ROI calculation itself, the figure of 4.75% demonstrates a small but positive return which is less than the mean library ROI/CBR of 1 : 4.9 identified by Aabø in her meta-analysis (2009), and less than the 1 : 3.5 CBR for an academic library's reference desk service (Harless & Allen, 1999), which was also derived using CV; however, as noted it is difficult to compare ROI figures for different libraries and services (Tenopir et al., 2010), and the ROI will theoretically increase year-on-year as the most significant element of the service costs – the implementation – decreases proportionally over time. The figure also needs to be viewed with some caution, since various assumptions have been made along the way, such as the estimation of the aggregated WTP amount and the calculation of service costs which involved several approximations due to the necessarily narrow scope of this study; nevertheless, the methodological approach suggests that it could be successfully applied to other types of service and perhaps to health library services as a whole.

As part of an overall framework for demonstrating library value, therefore, alongside impact on other key areas such as patient care and learning, the contingent valuation method should be considered a viable approach to evaluating the return on investment of NHS library services, one which demands significant commitment and resources in relation to data collection and statistical analysis, but which provides a credible evidence-based evaluation technique and a more reliable and conservative estimate than other commonly used methods.

Chapter 6: Conclusion

The purpose of this study was to calculate the return on investment (ROI) from Wexham Park Hospital library's out-of-hours access service, using the contingent valuation (CV) method. This has been achieved through a review of the literature and the design and implementation of a CV survey distributed to 305 library users who have recently borrowed an out-of-hours access card, followed by an analysis of the data provided on their willingness-to-pay (WTP) for the service. The survey response rate was 15.49%, and the sample mean WTP amount was calculated as £5.64 per person, in the form of an annual payment for the out-of-hours service, with a 95% confidence interval of £3.47 to £7.99.

The WTP data were then subjected to a regression analysis to determine whether the amounts correlated with several independent variables such as the distance to the library, pay band, and the extent to which a user would be affected by loss of out-of-hours access, in line with theoretical expectations, to test for construct validity. While the correlation coefficients suggested such relationships might exist between the variables, they were not statistically significant at $p<0.05$ and the null hypothesis that there was no correlation could not be rejected.

Nevertheless, in order to obtain an aggregated WTP for the population, the WTP amounts were weighted according to job category, in order to improve the sample's representativeness, and the total WTP amount for one year was found to be £2,287.50. For the three-year period since the implementation of the access system, this equated to £6,862.50, and this figure was then used in both ROI and cost-benefit ratio (CBR) formulae. Also entered into the formulae was the total service cost over the three years, which was found to be £6,551.36, based on a breakdown of fixed and variable costs categorised as either system, administrative or consumable costs. The ROI was calculated as 4.75%, and the CBR approximately 1 : 1.05.

The study also aimed to evaluate the validity of the CV method in the context of NHS libraries, since the literature review revealed that the technique has not previously been applied in this area. This has been achieved through the critical analysis and application of the CV methodology, which demonstrates that some of the biases associated with CV surveys can effectively be moderated through the use of techniques such as dissonance minimising and certainty questions, and also highlights some of the unique challenges and limitations in relation to data collection and the complexities of statistical analysis. The study concludes, in

line with findings in the literature, that the CV method is a viable, conservative evidence-based technique for evaluating public sector services which should be considered as an important tool available for use in the economic evaluation of NHS library services.

In terms of ROI generally, and in the context of planned research into this area for NHS libraries in England, the study also concludes – based on ROI research in other library sectors, and the comments obtained by stakeholder interviews – that while there is a definite need for libraries to demonstrate economic value, and that ROI therefore has a role in the overall evaluation framework for libraries, there are other types of impact, such as those related to national targets and initiatives, organisational strategic objectives, patient safety and care, and education, which continue to be of fundamental importance, and the challenge for NHS libraries in the future is to keep demonstrating value across this wide range of areas whilst at the same time proving their "value for money" to stakeholders and funding bodies.

6.1 Suggestions for Further Research

The study has shown that there is scope for further research in the application of CV to health libraries, and that the economic evaluation of other services, including the library as a whole and potentially health libraries at a regional or national level, may benefit from this technique. In particular, future studies may consider the use of alternate elicitation methods, as well as including non-users in surveys in order to capture option value. Improved response rates for CV surveys and the use of advanced regression analyses will further help to establish the validity of WTP data and enhance the credibility of ROI and CBR figures, which ultimately can be used to demonstrate the value of health libraries as part of a range of key impact measures to stakeholders and funding organisations.

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Appendix A: Interview Schedule

Background

This research is being undertaken as part of a Master's programme in Information & Library Studies from Aberystwyth University. The purpose of this study is to evaluate the Return on Investment of the out-of-hours access card service in the library at Wexham Park Hospital, using the Contingent Valuation method.

As part of this study, I am undertaking stakeholder/expert interviews to gain an understanding of views and opinions on the need for the library service to demonstrate its value to the organisation, the role of Return on Investment studies in the Trust and the NHS, and the Contingent Valuation method.

Why you have been chosen and how to obtain further feedback

You have been selected via a method of convenience/snowball sampling, and identified as a stakeholder or expert whose opinion will be relevant to the study. All the data provided by participants will be analysed and presented as part of a Master's dissertation; data analysis and conclusions will be sent to all interviewees on completion.

Anonymity

The interviews will be conducted according to normal research ethics guidelines. Any information you provide will remain confidential. It will be kept securely and only as long as necessary for the analysis and reporting. Any direct quotes will be used very selectively and will be non-attributable. You may request a copy of the interview notes for verification of the information provided.

Informed Consent Form completed? Yes/No

Recording method: Notes

Any questions?

Job Title / Position / Directorate:

1. How important is it for the library service to demonstrate its economic value to the Trust?

2. How useful would a Return on Investment percentage or Cost-Benefit Ratio be in this regard?

3. How could this data be presented to the Trust? *[E.g. Dashboard / scorecard / report]*

4. Are you familiar with the Contingent Valuation method? If so, how useful do you think this technique is, in terms of calculating value? *[Information sheet / Interviewer to prompt with examples if required]*

5. Are there any other economic evaluation methods that you are aware of, that the library could use to demonstrate value? *[E.g. Time savings / other cost savings]*

6. What other types of value should the library be seeking to demonstrate? *[E.g. Impact on patient-care, learning & teaching, evidence-based decision-making]*

Appendix B: Interview Information Sheet

Thank you for taking the time to consider participating in this study. This Information Sheet explains what the study is about, and how you might participate in it. Please read the information carefully and contact me if you have any questions. My contact details are at the end.

Purpose of the study

This research is being undertaken as part of a Master's programme in Information & Library Studies from Aberystwyth University. The purpose of this study is to evaluate the Return on Investment of an out-of-hours access card service in the library at Wexham Park Hospital, using the Contingent Valuation method. The results will be used to inform the future provision and evaluation of library services.

Contingent Valuation (CV) is a "stated preference" technique drawn from economic theory and survey research methods to elicit directly from consumers the values they place on public goods. It uses a survey describing a hypothetical choice within a hypothetical market to elicit estimates of willingness-to-pay (WTP) for, or willingness-to-accept (WTA), a particular outcome. CV studies elicit WTP or WTA via direct questions such as "What is the maximum amount you would be prepared to pay every year to receive good X?"

Your participation in the study will be via an interview, in order to elicit your views as a stakeholder/expert prior to the CV survey being undertaken.

Conduct of the study

Participation in the study is voluntary, and you are free to withdraw at any time.

The interview should only take about 15 minutes of your time. It will be either face-to-face or by telephone, depending on your availability, and I will take notes with your permission.

I will follow ethical and legal practice and all information about you will be handled in confidence. The information you provide will be kept securely and for only as long as necessary for the study. If you wish, you may see a copy of the notes. Any direct quotes included in the final report will used selectively and will be non-attributable, and you have the right to request that your quotes are not used in the report.

Our conversation will follow the accompanying Interview Schedule, though you can raise other issues if you wish.

If you wish to be interviewed, please sign the accompanying Consent Form and return it to me. I will then contact you to arrange a convenient day and time.

Once again, thank you for taking time to consider participating in this study.

Andrew Brown, Library Service Development Lead, Wexham Park Hospital
Ext. 4586
Email: andrew.brown@fhft.nhs.uk

Appendix C: The Contingent Valuation Survey

Introduction

In relation to research being undertaken as part of a Master's programme at Aberystwyth University, I would like to invite you to take part in this survey about the library's out-of-hours access card service.

The aim of this research is to evaluate the return on investment of the access card service. As you are aware, access cards give 24/7 access and are available to borrow for up to one year, with a £10 deposit required.

As a registered library member currently in possession of an access card, you have been randomly selected from the library's management system. I would be grateful if you could spare approximately **5 minutes** to take part in this survey.

The survey is being conducted according to normal research ethics guidelines. Any information you provide will remain strictly anonymous and confidential.

Thank you for taking the time to complete this survey.

Q1. Which of the following best describes your job category?

Additional Clinical Services	☐
Additional Professional, Scientific & Technical	☐
Administrative & Clerical	☐
Allied Health Professional	☐
Estates & Ancillary	☐
Healthcare Scientist	☐
Medical & Dental	☐
Nursing & Midwifery Registered	☐
Student	☐
Other (*Please specify*)	☐

Q2. How long have you had the out-of-hours access card?

Less than a month	☐
1 – 3 months	☐
3 – 6 months	☐
6 – 12 months	☐
More than a year	☐

Q3. How close do you live to the library?

Less than a mile	☐
1 – 5 miles	☐
More than 5 miles	☐

Q4. Which pay band or range are you in?

Band 2 (£15-17K)	☐
Band 3 (£16-19K)	☐
Band 4 (£19-22K)	☐
Band 5 (£21-28K)	☐
Band 6 (£26-34K)	☐
Band 7 (£31-40K)	☐
Band 8a (£39-47K)	☐
Band 8b (£46-57K)	☐
Band 8c or higher (£55K +)	☐
Prefer not to say	☐

Q5. Have you used the access card at all since borrowing it?

Yes	☐
No (*If "No", go to Q6)*	☐

Q5a. On average, how many times a month do you use the card to gain out-of-hours access (e.g. evenings/weekends)?

1 - 2 uses each month	☐
3 - 5 uses each month	☐
5 - 10 uses each month	☐
10 - 15 uses each month	☐
15 – 20 uses each month	☐
Over 20 uses each month	☐

Q5b. On average, how long do you spend in the library during each out-of-hours visit?

Less than one hour	☐
1 - 2 hours	☐
3 – 4 hours	☐
5 – 6 hours	☐
Over 6 hours	☐

Q5c. What are your main reasons for accessing the library out-of-hours? (Please tick all that apply)

Quiet place to study	☐
Access to Trust PCs (*Go to Q5c.1*)	☐
Access to photocopier/printer/scanner (*Go to Q5c.2*)	☐
Free Wi-Fi	☐
Access to library books & journals	☐
Meeting colleagues for group study etc.	☐
Other (*Please specify*)	☐

Q5c.1. How long, on average, do you use the PC each visit?

Less than one hour	☐
1 - 2 hours	☐
3 – 4 hours	☐
5 – 6 hours	☐
Over 6 hours	☐

Q5c.2. How many pages do you copy/print/scan each visit?

Less than 5 pages	☐
5 - 10 pages	☐
10 – 20 pages	☐
More than 20 pages	☐

Q5d. Are your activities in the library related to any of the following? (Please tick all that apply)

Education & Training	☐
Patient care	☐
Management	☐
Personal / Leisure	☐

Q6. Overall, how satisfied are you with the out-of-hours access system?

Very satisfied	☐
Satisfied	☐
Neither satisfied nor dissatisfied	☐
Dissatisfied	☐
Very dissatisfied	☐

Q7. To what extent would your work be affected if you did not have access to the library out-of-hours?

Unaffected	☐
Somewhat affected	☐
Severely affected	☐

Q8. Please us the space below to provide additional feedback about the 24 hour access card system:

Valuation Questions

*The following questions are designed to help value the out-of-hours access card service. They are based on the **hypothetical** situation in which the library has to consider charging in order to keep the access card system operational.*

*They are **not** an indication that charges will be introduced in reality.*

Q9. Would you be prepared to make an annual payment for the access card (i.e. not a deposit)?

Yes – I value out-of-hours access and would be prepared to make an annual payment (*Go to Q9a*)	☐
No – I value out-of-hours access but cannot afford to make an annual payment	☐
No – I value out-of-hours access but would rather spend my money on other things	☐
No – I would not mind if out-of-hours access was not available	☐
Don't know / not sure	☐

Q9a. What is the <u>maximum</u> that you would pay for an annual year's out-of-hours access card, in order to keep using the library out-of-hours?

Although this is a hypothetical question, please think about the amount as if you were actually making a payment for real. Please do not agree to pay more than you would in reality, or an amount that you might not be able to afford.

Remember that there might be something else that you would rather spend this money on, or that you might have somewhere else to do your work if the library is not open in the evenings or at weekends.

☐ £0	☐ £10	☐ £30
☐ £1	☐ £12.50	☐ £35
☐ £2	☐ £15	☐ £40
☐ £3	☐ £17.50	☐ £45
☐ £4	☐ £20	☐ £50
☐ £5	☐ £25	☐ Other amount (*Please specify*)

Q10. How certain are you that you would pay this amount for an out-of-hours access card?

Very certain	☐
Somewhat certain	☐
Not at all certain	☐

Thank you for taking the time to complete this survey.

As a final reminder, please note that the library has **no intention** of charging for access cards; the valuation questions in the survey were **solely** intended to help estimate a value for the benefits of the access card system, in order to evaluate the overall return on investment of the system to the Trust. If you would like to ask any questions about this survey, or would like to request a copy of the final dissertation, please contact andrew.brown@fhft.nhs.uk.

Appendix D: Interview Consent Form

Title of project: Using Contingent Valuation to evaluate the Return on Investment of a library's out-of-hours access card system

Name of researcher: Andrew Brown

Project authority: This research is being undertaken as part of a Master's programme in Information & Library Studies from Aberystwyth University.

	Please tick
1. I have read and understood the information sheet for participants and a researcher has explained the study to me.	☐
2. I have received enough information about what my role involves.	☐
3. I understand that my decision to participate is entirely voluntary and that I am free to withdraw from the study at any time, without having to give a reason and without my legal rights being affected.	☐
4. I agree to notes being taken of the interview.	☐
5. I understand that I may ask for a copy of the notes, and that I may request that no direct quotes of mine be used in the report.	☐
6. I agree to participate in the above study.	☐

Name of participant	**Signature**	**Date**
Name of researcher	**Signature**	**Date**

Please return this Consent Form to:

Andrew Brown, Library Services Development Lead
Library, Postgraduate Centre, Wexham Park Hospital, Ext. 4856
andrew.brown@fhft.nhs.uk

Appendix E: Bootstrapping Programme

```
DATA (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 5 5 10 10 10 10 10 10
12.5 15 15 20 20 20 20 20 20 25) wtpSample
REPEAT 100000
SAMPLE 46 wtpSample newSample
MEAN newSample newSampleMean
SCORE newSampleMean means
END
HISTOGRAM percent binsize 0.1 means
PERCENTILE means (2.5 97.5) confidenceInterval
PRINT confidenceInterval
PRINT newSampleMean
```

Used in *Statistics101*, based on an example by Grosberg (2015, p. 42).

Appendix F: Re-tabulated Survey Data for Regression Analysis

WTP	Distance	Pay Band	Frequency	Duration	Satisfaction	Affected
0.00	1	2	2	2	5	2
0.00	3	5	1	5	5	2
0.00	3	5	1	2	5	2
0.00	1	6	1	1	5	2
0.00	2	3	2	6	5	3
0.00	2	6	2	3	5	3
0.00	3	5	1	2	5	2
0.00	1	5	4	3	5	3
0.00	2	5	2	2	5	3
0.00	2	8	6	5	5	3
0.00	1	2	4	2	5	3
0.00	2	5	2	1	4	2
0.00	1	7	2	2	5	2
0.00	2	6	5	5	5	3
0.00	1	7	1	3	5	2
0.00	2	7	1	5	5	2
0.00	2	4	2	5	4	3
2.00	1	6	3	6	5	3
5.00	1	6	2	3	5	2
5.00	2	7	3	3	5	3
10.00	3	5	1	2	4	3
10.00	3	3	1	2	5	1
10.00	1	5	4	6	1	3
10.00	2	3	5	2	5	3
10.00	2	9	3	3	5	2
10.00	2	7	2	3	5	3
12.50	3	5	3	5	5	3
15.00	2	6	3	5	5	3
15.00	3	6	3	3	5	2
20.00	1	7	2	3	5	3
20.00	1	7	1	3	5	2
20.00	3	9	4	2	5	3
20.00	2	6	3	6	5	3
20.00	1	2	1	2	5	2
25.00	3	5	1	3	5	2

Appendix G: PSPP Regression Output

Model Summary (WTP)

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
.23	.05	-.15	8.73

Coefficients (WTP)

	Unstandardized Coefficients		*Standardized Coefficients*			*95% Confidence Interval for B*	
	B	*Std. Error*	*Beta*	*t*	*Sig.*	*Lower Bound*	*Upper Bound*
(Constant)	2.08	14.09	.00	.15	.884	-26.79	30.94
Distance	1.70	1.95	.16	.87	.390	-2.29	5.69
PayBand	.67	.86	.15	.78	.444	-1.09	2.43
Frequency	-.39	1.41	-.07	-.28	.782	-3.28	2.49
Duration	-.09	1.11	-.02	-.08	.936	-2.36	2.18
Satisfaction	-.56	2.18	-.05	-.26	.800	-5.03	3.91
Affected	.71	3.55	.05	.20	.843	-6.56	7.98

Appendix H: Service Cost Calculations

System Costs

Based on purchase orders and invoices kept by the library, the cost breakdown, including VAT, for the three-year period is as follows:

Installation (including delivery)	£4,975.20
Access cards x 200	£870.00
Access cards x 200	£870.00
TOTAL	**£6,715.20**

Administration Costs

For each card borrowed, it is assumed that the total staff time required is 5 minutes. For 305 cards, this equates to 1,525 minutes, or 25.42 hours. Therefore, over the three-year period, this amounts to 76.25 hours.

It is assumed that transactions are carried out by a full-time Library Assistant, on the mid-point of the Band 3 pay scale with a salary of £17,972 per annum (NHS Employers, 2015).

This was entered into the online "hourly rate" calculator available via the NHS Library & Knowledge Services Wiki (2015), and the final hourly rate was found to be £12.81.

The total cost in staff time for issuing and returning access cards during the three-year period is therefore 76.25 x £12.81 = £976.76.

Approximately 200 overdue emails were sent in the three-year period, each taking around 2 minutes of staff time to generate. Using the hourly rate above, the total cost was calculated as ((200 x 2)/60) x £12.81 = £85.40.

The total administrative costs in staff time for the three-year period are therefore as follows:

Issuing and renewing access cards	£976.76
Overdue reminders	£85.40
TOTAL	**£1,062.16**

For access cards that are lost or not returned, the £10 deposit is retained by the library and enters the library budget as income. Approximately 216 deposits were retained over the three-year period, resulting in income of £2,160 which will be deducted from the final calculation.

Consumable Costs

From the CV survey, both the average number of visits per month (Q5a) and the average amount of time spent on computers (Q5c.1) were used to estimate the total number of visits during the three-year period, and the total amount of time spent actively using library computers during those visits. The following figures were obtained:

Total visits per month (to use computers)	149
Average time spent on a computer during each visit (hours)	2.929
Total number of visits in 3 years	5,364
Total time spent on computers in 3 years (hours)	15,709

In order to convert this final figure into costs, the cost of electricity and the power required to run the computers were based on calculations by the University of London, Birkbeck in 2014 for similar desktop computers (BBK, 2014):

Cost of electricity (pence per kilowatt hour)	10.466p/kWh
Monitor – power required in kilowatts	0.021kW
Desktop computer – power required in kilowatts	0.052kW
Total power required for computer	0.073kW

Taking the total number of hours spent on computers, the amount in kilowatt hours is therefore 15,709 x 0.073 = 1,146.75kWh, and the total cost is calculated as 1,146.75 x 10.466 = 12,001.85p or £120.02.

It is also assumed that all 17 library computers are in an idle state during evenings and weekends, unless they are being actively used.

For the three-year period, minus the total active use figure above, the total idle time is estimated as 97,443.14 hours. Assuming that an idle desktop computer uses 0.03kW (BBK,

2014), the above calculation steps can be repeated to result in an overall total of £305.95. The total cost over the three years in terms of out-of-hours computer use is therefore £425.97.

The cost of out-of-hours usage of the combined printer/photocopier/scanner can be calculated in a similar manner. Returning to the CV survey data, the responses to question 5c.2 (the number of pages printed/photocopied/scanned on an average visit) yield the following estimates:

Total visits per month (to use printer/copier)	141
Average number of pages printed/copied during each visit	9.375
Total number of visits in 3 years	5,076
Total number of pages printed/copied in 3 years	47,587.5
Total time in hours that the printer/copier is in use (assuming 5 seconds per printed page)	66.09

The power required to run the printer/photocopier is taken as 0.5kW (EnergyUseCalculator.com, 2015), and using the same cost of electricity as above, this works out as (66.09 x 0.5) x 10.466 = 345.87p or £3.46 for the three-year period. The cost of idle time for the three years is calculated (based on a power requirement of 0.05kW) along similar lines, resulting in a total of £34.48. Therefore, the overall cost (in electricity) of the printing out-of-hours is £37.94.

A4 paper for the printer costs £8.50 for 2,500 sheets, based on previous library purchases. For the total number of pages used in three years (47,587.5) this works out as £161.80 in total.

The average cost of toner, including VAT, for the particular model in the library – a Xerox Work Centre 6400 - (according to Xerox.co.uk, 2015) is £77.74 for 12,000 pages. This equates to £308.29 for the pages printed in the three-year period.

Therefore, the total cost of out-of-hours printing over the three years, including electricity, paper and toner costs, is £508.03, and the total consumable costs are:

Use of computers	£425.97
Use of printer/photocopier	£508.03
TOTAL	**£934.00**