

**Cost effectiveness review 1: The cost-effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people**



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## **About the ScHARR Public Health Collaborating Centre**

The School of Health and Related Research (ScHARR), in the Faculty of Medicine, Dentistry and Health, University of Sheffield, is a multidisciplinary research-led academic department with established strengths in health technology assessment, health services research, public health, medical statistics, information science, health economics, operational research and mathematical modelling, and qualitative research methods. It has close links with the NHS locally and nationally and an extensive programme of undergraduate and postgraduate teaching, with Masters courses in public health, health services research, health economics and decision modelling.

ScHARR is one of the two Public Health Collaborating Centres for the Centre for Public Health Excellence (CPHE) in the National Institute for Health and Clinical Excellence (NICE) established in May 2008. The Public Health Collaborating Centres work closely with colleagues in the Centre for Public Health Excellence to produce evidence reviews, economic appraisals, systematic reviews and other evidence based products to support the development of guidance by the public health advisory committees of NICE (the Public Health Interventions Advisory Committee (PHIAC) and Programme Development Groups).

## **Contribution of Authors**

Alejandra Duenas was the lead modeller. Emma Everson Hock and Roy Jones were systematic reviewers on the project. Louise Guillaume developed and undertook literature searches. Elizabeth Goyder and Jim Chilcott were the senior leads.

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The Health Survey for England is commissioned by the Department of Health, and conducted by the Joint Health Survey Unit of National Centre for Social Research and Department of Epidemiology and Public Health at University College London. Ethical approval for the Health Survey for England was obtained from the London Multi-Centre Research Ethics Committee.

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## **1 Executive Summary**

### **Background**

An economic model was developed in order to estimate the cost-effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people. This present model is based on the first effectiveness review in the series of three reviews on the public health programme guidance on improving the physical and emotional health and well being outcomes for looked after children and young people (LACYP). In 2008, approximately 7000 young people reached an age when they were no longer looked after (Department for Children Schools and Families 2009). Care leavers are more likely to have poorer outcomes (education, employment substance misuse, offending behaviour, parenthood and housing) than young people in the general population because they are less likely to have family support and therefore their transition to adulthood may be more difficult. Local Authorities maintain financial and moral responsibility for LACYP aged between 16 and 21 years and up to 24 years if in education or training.

### **Objective**

The primary objective of this evaluation is to appraise the cost-effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people.

### **Methods**

Economic analyses were performed to model the cost-effectiveness and cost utility of support services for transition to adulthood/leaving care (TSSs) that are delivered towards the end of care for looked after young people.

The model was designed in order to assess different adult outcomes. It assessed the effectiveness of TSS interventions on employment, crime and mental health with a life-time horizon using a public sector, including criminal justice services (CJS), education, housing, NHS and personal social services (PSS) perspective.

The results are presented in terms of incremental cost-effectiveness ratios (ICERs). The model evaluated the cost-effectiveness of the intervention in males and females. Detailed reviews were undertaken to obtain the most recent evidence on costs and

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utilities for the different states modelled. UK specific data were used although the effectiveness of employment status was taken from US setting studies.

### **Results**

The results for the economic analysis, over a life time, suggest that TSS interventions in young males were dominant in most cases. The analysis considered employment status effectiveness found by the first in the series of three effectiveness review performed by ScHARR. Although it appears that TSS interventions for young females dominate no-TSS interventions, the results vary significantly when compared to the males' results. This is due to the difference between crime rates for males and females.

### **Discussion**

The results generated are sensitive to the gender of the young people leaving care, to their employment status and to the amount of crime that they commit. The majority of results are governed by the costs incurred by the Criminal Justice Services. The analysis demonstrates that TSS interventions for young people leaving care (compared to no-TSS interventions) can be cost-effective if the interventions focus on skills to find employment. Further research is required to allow inclusion of other adult outcomes such as education and housing.

The major uncertainties in this assessment relate to the probability of getting a job after leaving care, having a major influence on the cost-effectiveness ratios. Considerable variation is present in another parameter of the study, i.e. the cost of the intervention (TSS). This parameter has a major influence on the cost effectiveness estimates for TSS.

### **Conclusion**

Evidence suggests that TSS interventions are effective in increasing the number of young people leaving care that are able to find employment.

The cost effectiveness results suggest that TSSs dominate no-TSS when the interventions focus on employment skills. Both young males and females will be less likely to commit a crime if are employed. Employment will also have an influence on health outcomes such as mental health particularly for young females.

## **2 Introduction**

This study was undertaken in parallel with a systematic review on the effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people. The systematic review aimed to identify and synthesise evidence on the effectiveness of support services for transition to adulthood/leaving care (TSSs) that are delivered towards the end of care for looked after young people (no age limit applied) on their adult outcomes. The outcomes considered were: education, employment, substance misuse, criminal and offending behaviour, parenthood, housing and homelessness and health. A review of cost-effectiveness of TSSs for looked after young people was also undertaken with the primary objective of systematically identifying and evaluating methodologies used in TSS's economic evaluations.

## **3 Review of Previous Economic Studies**

### **3.1 Search strategy**

Studies were identified through searches of economic databases: EconLit and NHS EED. All searches were undertaken in February 2009. A list of the keyword strategies and the sources consulted are given in Appendix 1.

### **3.2 Results of review**

Electronic literature searches identified 301 potentially relevant publications from the database supplied by SCIE. Of these, 2 studies were identified as potentially relevant to the economic analysis. More detailed evaluations revealed that these studies were not applicable. Targeted searches for model parameters were also undertaken in Web of Science, Medline, NHS EED and Econlit, from which 348 references were retrieved.

## **4 Economic Assessment**

### **4.1 Objective**

The primary objective of this evaluation is to appraise the cost-effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people.

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### **4.2 Methods**

A cohort model was developed to explore the cost and benefit outcomes associated with TSSs for LACYP. A Markov model was used to determine the cost and benefits over a life time horizon. The effectiveness of interventions was obtained from the systematic review conducted by SchARR on the effectiveness of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people.

The results are presented in terms of incremental cost-effectiveness ratios (ICERs).

#### *Population considered in the economic evaluation*

The population comprised LACYP and/or adults who were previously looked after as children and/or young people. No age limits at the time of intervention were applied.

#### *Comparator*

The comparator was usual care/no intervention.

#### *Outcomes*

The following adult outcomes were of particular interest: housing, alcohol/drug misuse, employment, educational attainment, employment, criminal/offending behaviour and physical, mental and sexual health.

#### *Effectiveness of interventions*

This model is informed with evidence of interventions' (TSSs') effectiveness and their link with outcomes found in the systematic review. A total of seven cohort studies were identified: five retrospective cohort studies (Cook 1994;Georgiades 2005) (Lemon, Hines, & Merdinger 2005) (Lindsey & Ahmed 1999) (Scannapieco,



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Schagrin, & Scannapieco 1995) and two prospective cohort studies (Austin 1993) (Biehal et al. 1995). The majority of identified studies were conducted in a US setting, with one UK-based study (Biehal, Clayden, Stein, & Wade 1995). The effectiveness evidence of these studies is summarised in Appendix 2. From the effectiveness evidence it can be seen that the most common factor to the studies is the impact that TSSs interventions have on employment. The characteristics of employment are summarised below in Table 1.

**Table 1: Employment effectiveness**

<b>Study</b>	<b>Outcomes</b>	<b>Outcome in TSS group (percent and number)</b>	<b>Outcome in no-TSS group (percent and number)</b>	<b>Significance (p-level)</b>
Georgiades (2005)	Employed full-time	22%	8%	ES=.53
	Employed part-time	51%	0%	
	Unemployed	27%	92%	
Lemon (2005)	Had a job immediately after discharge	58.4% (45)	73.8% (79)	p<0.05
Lindsey (1999)	Employed full-time	41%	22%	NS
	Employed part-time	18%	22%	NS
Scannapieco (1995)	Employed at case closing	52.3% (23)	26.1 (12)	NR
Austin (1993)	Employed part-time/summer/full-time at discharge	31%	25%	NS
	Unemployed at discharge	69%	75%	NS
	Employed part-time/summer/full-time at 1 year	50%	37%	NS
	Unemployed at 1 year	50%	63%	NS

NS - not statistically significant

NR – not reported

ES – Effect Size

Note that in Lemon et al (2005) the employment outcome in the TSS group is less favourable than in the non-TSS group, which explains why the cost effectiveness results derived later in this report using this study are also in the “wrong” direction.

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Full effectiveness evidence and studies quality can be found in the systematic review: “The effect of support services for transition to adulthood/leaving care on the adult outcomes of looked after young people” conducted by SchARR.

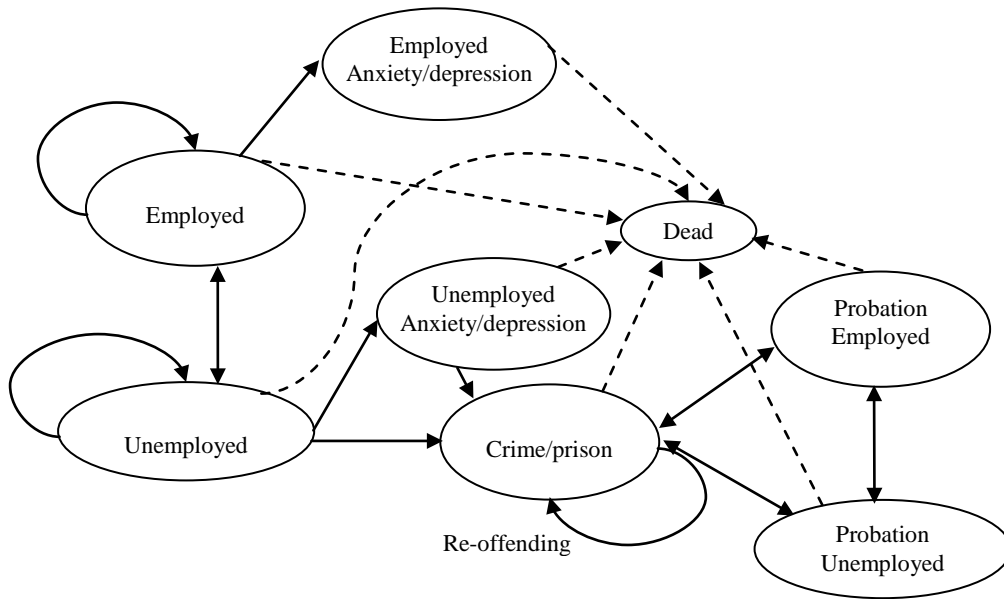
### *Structure of the model*

A cohort model is used to explore the pathway followed by a young person after leaving care. From the evidence found by the systematic review, the factor that is common to all studies is employment status. Employment represents one of the outcomes outlined above and it is possible to make the assumption that it is linked to other outcomes such as criminal offending behaviour, physical, mental and sexual health and housing. Due to the lack of reported evidence three outcomes were modelled: employment, mental health and crime. A cohort model has been used to describe the pathways of individuals that were looked after. The pathway is divided into seven different possible states.

### *Cohort states modelled*

For both TSS interventions and no intervention there are seven possible states: a) employed no anxiety/depression, b) employed with anxiety/depression, c) unemployed no anxiety/depression, d) unemployed with anxiety/depression, e) crime/prison, f) employed on probation, g) unemployed on probation and h) dead all causes. In this way, both TSS interventions and no-TSS have the same structure and what changes is the effectiveness of employment that is initially input into the model. Figure 1 shows the cost-effectiveness model structure. During each year of cycle of the model a proportion enter one of the seven states defined in figure 1.

Figure 1: TSSs/No-TSSs cost-effectiveness model structure



*Time horizon*

The model explores the cost and benefits accrued through the measured outcomes a life long period. This timeframe is defined as the study design considered adult outcomes (e.g. education, employment, substance misuse, criminal and offending behaviour, parenthood, housing and homelessness and health).

*Perspective*

The primary perspective is public sector, including criminal justice services (CJS), education, housing, NHS and personal social services (PSS), where appropriate outcomes from a wider perspective may also be generated covering both cost and effect outcomes. The intervention costs are expected to be incurred principally by the public sector; however, the interventions may also result in changed demand for NHS and PSS services.

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*Probabilities of employment by age and gender*

A logit model was developed in order to calculate the probability of employment by age and gender using the (National Centre for Social Research and University College London, Department of Epidemiology and Public Health 2008). These probabilities were used to determine the annual transitions from unemployment to employment after age 18.

The transition probabilities from employment to unemployment were calculated using the total job separation rates by age in 2007 (Kent K 2008) presented in Table 2. Kent defines job separation as ‘the end of the employment relationship between employer and employee’. A job separation may be voluntary or involuntary.

**Table 2: Total job separations\* 2007 (adapted from (Kent K 2008))**

<b>Age</b>	<b>Percentages per year</b>
16-24	8.5
25-34	4.0
35-49	2.5
50-59/64	2.5

\* Total job separations include voluntary and involuntary separations

The transition probabilities for unemployment were calculated using the data reported by the Office for National Statistics based on the Labour Force Survey ((Office for National Statistics 2003), Table 4.22).

**Table 3: Duration of unemployment<sup>1</sup>: by sex and age, 2003  
United Kingdom**

	<u>Less than 12 months</u>
<b>Males</b>	
16-19	88%
20-29	82%
30-39	67%
40-49	65%
50-64	62%
All aged 16 and over	
<b>Females</b>	
16-19	91%
20-29	88%
30-39	81%
40-49	77%
50-59	56%
All aged 16 and over	88%

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*Probabilities of anxiety/depression by employment status, age and gender*

A logit model was developed in order to calculate the probability of anxiety/depression by employment status age and gender. The dataset used was taken from the survey of psychiatric morbidity among adults in private households carried out in 2000 (Singleton N et al. 2001). These probabilities were used to determine the transitions from unemployment and employment to employed people suffering anxiety/depression and unemployed people suffering anxiety/depression from age 16.

(Georgiades 2005) reported 2% of young people who received TSS interventions were in jail compared to 18% of young people in jail who did not receive TSS interventions. These percentages represented all the population including male and female. However, there is a significant difference between the number of males and females that are currently in prison (Ministry Of Justice 2009). From Table 4, it can be seen that of the total of young adults (aged 18 – 20), almost 96% are male. Therefore, the estimated proportion of TSS young males (18 years) in prison is 1.91% (2% multiplied by 95.8%) whilst the proportion of young females in prison is approximately 0.01% (2% multiplied by 4.2%).

**Table 4. Population in prison by offence - remand and immediate custodial sentence, (Ministry Of Justice 2009)**

	Number	Percentage
All male prisoners	64136	95.1%
All female prisoners	3337	4.9%
All prisoners*	67473	100.0%
All adult male prisoners	55367	94.9%
All adult female prisoners	2990	5.1%
All adult prisoners	58357	100.0%
All male aged 15-17	1667	97.89%
All female aged 15-17	36	2.11%
All aged 15-17	1703	100%
All male young adults**	7102	95.8%
All female young adults	311	4.2%
All young adults	7413	100.0%

\* All prisoners include adults, aged 15-17 and young adults

\*\*Young adults = aged 18 – 20 (including those 21 years old that were aged 20 at conviction)

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*Probabilities of re-offending and employment*

A weighted average that considered the number of people in immediate custody and the average custodial sentence for violence against the person, burglary, criminal damage, drug offences and sexual offences is calculated. This weighted average represented the average custodial sentences in months for a person in jail and it is approximately 24 months.

The percentages of employment by gender of offenders on probation were taken from the Home Office Research Study 167 (Mair G & May G 1997). It was reported that 23% male offenders on probation were employed compared with only 12% female offenders. This is due to the great number of female offenders on probation (42%) that were looking after home or family. The re-offending rates were obtained from the Statistics bulletin from the Ministry of Justice (Ministry Of Justice 2006), where a 39% re-offending rate in 2006 was reported.

*Costs and resources used*

The costs of the TSS interventions are based on the process model defined by Ward, Holmes, & Soper (2008). The authors adjusted the core information requirements process version 2 model (Level 2 process 1.4) (Department Of Health 2001) and determined 8 processes to be costed (Table 1). Ward, Holmes, & Soper (2008) determined mean costs for looked after children and young people based on average costs of six local authorities. Table 5 shows the basic costs to children's social care for a LACYP in foster care (outside London).

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<b>Table 5: Basic costs to children’s social care (outside London). (Ward, Holmes, &amp; Soper 2008)</b>		
Process		Cost (2006-7)
Process 1	Deciding child needs to be looked after and finding a first placement	£639
Process 2	Care planning	£120
Process 3	Maintaining the placement (per month)	£1,689
Process 4	Leaving care/ accommodation	£263
Process 5	Finding a subsequent placement	£205
Process 6	Review	£408
Process 7	Legal interventions	£2,765
Process 8	Transition to leaving care services	£1,164

TSSs interventions are related to process 8. This process was costed at the moment the young person (16+) is transfer to the “leaving care team” (Ward, Holmes, & Soper 2008). Process 8 is considered as a planning process. There are other costs associated to children’s social care and the cost to other agencies (education, health and criminal justice services).

The costs of TSSs were calculated based on a study of costs and outcomes of young people leaving care conducted by (Dixon & Wade J 2004). The information of resource use that was reported for the studies is shown in Table 6. The estimated total cost of all services used per young person per week is taken from (Dixon & Wade J 2004) and adjusted to 2009 prices using Focus on Consumer Prices reported by the Office for National Statistics ( 2009b). The average estimated total cost of services used per young person per annum is £24,429. The cost of TSSs alone without considering accommodation is estimated as £6,078.

Costs to other sectors, particularly relating to health and crime, are also considered. The cost of crime includes the costs of the criminal justice system, to the victim and the costs incurred per prisoner. The costs to the criminal justice system and to the victim were reported by Brand & Price (2000). They estimated average costs by

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crime type considering costs as consequences of crime and cost in response to crime. An average cost of immediate custody considering violence against the person, burglary, criminal damage, drug offences, and sexual offences was calculated. The estimated average cost incurred by the criminal justice systems per crime is £12,625.

The costs per prisoner per type of prison are taken from the ESRC Society Today (2009) overview of key information and statistics of organisational performance in the UK. The estimated annual cost per male in a local prison is £27,275 and the estimated annual cost per female in a local prison is £42,477 (having converted to 2009 prices: Focus on Consumer Prices).



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**Table 6. Unit cost of services used by young people (adapted from Table 8.1; University of York; (Dixon & Wade J 2004)**

<b>Services</b>	<b>Unit cost (£)</b>	<b>Source</b>
Leaving care worker/personal adviser (per hour of client related activity)	20	Direct calculation
Foster care (per day)	74.5	Netten & Curtis, 2007
Hostel (per day) (based on local authority staffed hostel including expenses)	72	Netten & Curtis, 2008
Supported accommodation (per day) (based on local authority staffed hostel including expenses)	72	Netten & Curtis, 2008
B&B/hotel (per day)	34	Finn <i>et al.</i> , 2000
Family support worker (per contact hour)	22	Netten & Curtis, 2008
Housing officer (per hour of client related activity) (assumed equivalent to social worker cost)	37	Netten & Curtis, 2008
Social worker (per hour of client related activity)	37	Netten & Curtis, 2008
Support worker (per hour of client related activity)	37	Netten & Curtis, 2008
Social work assistant (per hour of client related activity)	24	Netten & Curtis, 2008
<b>Education services</b>		
Special school (per pupil per year)	21,266	CIPFA, 2000
Home tuition (per hour)	31	Berridge <i>et al.</i> , 2002
Connexions, careers advice, education adviser (per hour) (based on educational social work team member)	29	Netten & Curtis, 2006
<b>Hospital services</b>		
Inpatient (per day)	277-684	CIPFA 2002
Outpatient (per attendance)	88-233	CIPFA 2002
Accident and Emergency (per attendance)	48-85	CIPFA 2002
<b>NHS community services</b>		
NHS child clinical psychiatry team member (per hour of client contact)	66	Netten & Curtis, 2008
Health visitor (per hour of client related activity)	83	Netten & Curtis, 2008
Community psychiatric nurse (per half hour of client contact)	36.5	Netten & Curtis, 2008
Counselling (per hour)	31	Netten & Curtis, 2008
Dietician (per hour of client related activity)	30	Netten & Curtis, 2008
General practitioner (per 11.7 minute consultation)	36	Netten & Curtis, 2008

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Practice nurse (per hour of client contact)	29	Netten & Curtis, 2008
Dentist (per appointment)	5.32	<a href="http://www.doh.gov.uk">www.doh.gov.uk</a>
<b>Voluntary sector services</b>	<b>Unit cost (£)</b>	<b>Source</b>
Drug & alcohol services (per hour spent with patient) (based on district nurse cost)	60	Netten & Curtis, 2008
Counselling services (per hour) (based on counselling services in primary medical care)	31	Netten & Curtis, 2008
Day nursery (per place per session) (based on local authority costs)	30	Netten & Curtis, 2005
Family support services (per contact hour)	37	Netten & Curtis, 2008
Barnardos advocacy worker (per hour of client related activity) (based on social worker cost)	37	Netten & Curtis, 2008
Homeless young person's unit (per hour of client related activity) (based on social worker cost)	37	Netten & Curtis, 2008
Mentoring scheme (per hour of client related activity) (based on social worker cost)	37	Netten & Curtis, 2008
Victim support (per hour of client related activity) (based on social worker cost)	37	Netten & Curtis, 2008
Drop-in centre (per hour of client related activity) (based on 1/3 of local authority day care)	11.67	Netten & Curtis, 2008
Support group (per hour of client related activity) (based on 1/3 of local authority day care)	11.67	Netten & Curtis, 2008
Helpline (per call) (based on costs reported by the Samaritans)	2.31	<a href="http://www.samaritans.org.uk">www.samaritans.org.uk</a>
<b>Domestic accommodation</b>		
Domestic accommodation (per day)	15.73-56	Central Statistical Office 2000-2001 <a href="http://www.bcis.co.uk">www.bcis.co.uk</a>
<b>Youth justice</b>		
Magistrates court (per episode)	584	Healey <i>et al.</i> , 1998
Secure care (per day)	358	HM Prison Service, 2003
Lawyer (per contact)	50	Legal Services Commission, 2003
Youth offending institution / prison (per day)	45-91	H M Prison Service, 2003
Youth offending team worker (per hour of client related activity) (assumed equivalent to social worker cost)	37	Netten & Curtis, 2008
Probation officer (hour of client related activity) (assumed equivalent to social worker cost)	37	Netten & Curtis, 2008

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Asylum office (per hour) (based on social worker cost)	37	Netten & Curtis, 2008
Police custody (per 15 minute contact)	13.44	Finn <i>et al.</i> , 2000

<b>Benefits</b>	<b>Unit cost (£)</b>	<b>Source</b>
University of York, Dixon J. (2006)		
Baseline, young people (16-17 years old) were living on average per week:	55.4	Dixon J, 2006
Modal income per week (16-17 years old):	42.7	Dixon J, 2006
Under 25; (benefits: personal allowance, jobseeker's allowance per week)	47.95	CPAG, 2008
25 over; (benefits: personal allowance, jobseeker's allowance per week)	60.5	CPAG, 2008
Local Housing Allowance per week, 1 bedroom (average of 12 cities including London, Portsmouth, Birmingham, Manchester)	75.36	LHA direct

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**Table 7: Costs per prisoner for types of prison in England and Wales**

<b>Category</b>	<b>Cost per prisoner per day</b>
Male local	£61
High Security	£118
Category B	£57
Category C	£53
Male open	£56
Male remand centre	£71
Male closed young offender institution	£79
Male open young offender institution	£50
Male juvenile	£100
Female local	£95
Female closed	£87
Female open	67
Semi open	£64

(McCrone et al. 2008) reported the costs of mental health in England. This report was published by the King's Fund and reported an average service costs in 2007 for people with depression of £2,085.

#### Income by age

The estimates of income by age to be applied to adults in employment were obtained from (H M Revenue and Customs (2008).

#### Utilities

The Health Survey for England (HSE) (National Centre for Social Research and University College London, Department of Epidemiology and Public Health 2008) was used to calculate the utilities of related adult outcomes. The HSE comprises data of a random sample of the population living in private households in England. The survey carried out in 2006 consists of 21,399 records including children (aged 0 to 15) and adults (aged 16 to 65+). Individuals aged 16 to 65+ were asked to complete the EuroQol (EuroQol Group 2009) questionnaire (N=12,913) to obtain EQ-5D index scores. These data allow the generation of EQ-5D scores for the model states defined above (e.g., employed no anxiety/depression, employed with

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anxiety/depression, unemployed no anxiety/depression, unemployed with anxiety/depression etc). Multivariate regression analyses were undertaken in order to calculate the utility by age, gender, employment and mixed anxiety/depression. The main objective was to calculate utility loss associated with crime, unemployment and mental illness (depression).

The main interest was to estimate utility values to populate the states defined in the model structure. The EQ-5D was regressed onto age, sex, employment status and depression/anxiety using ordinary least square (OLS) techniques for comparison. The model is of the general form:

$$Q_i = \beta + \beta_1 w_i + \beta_2 x_i + \beta_3 y_i + \beta_4 z_i + \epsilon_i \text{ where}$$

$Q_i$  represents the EQ-5D score of the  $i$ th respondent,  $\beta$  represents the vector of unknown variables,  $w$  represents age,  $x$  represents sex,  $y$  represents employment,  $z$  represents depression and  $\epsilon_i$  represents the stochastic error term of the regression (the residual). Sex, employment and depression were entered as dummy variables with zero representing male, currently employed and not anxious or depressed respectively. The models were constructed in STATA (v6).

Table 8 presents the coefficients and significance of quality of life by age, sex, employment status and depression. The predictive ability of the model was compared using the mean absolute error (MAE) and the root mean squared error (RMSE).

**Table 8: How the utility score is affected by age, gender, unemployment and depression**

Q=QoL	Coef.	Std. Err.	P
Age	-0.00234	0.000107	0
Female	0.004237	0.003394	0.212
Unemployed	-0.08977	0.003874	0
Depressed	-0.28679	0.004344	0
Constant	1.061535	0.005486	0
<b>Errors in predicted values for individual level patient (N=12,913) responses</b>			
MAE	0.123394		
RMSE	0.186912		
R-squared	0.3578		

P = Probability due to chance

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Mortality

Office of National Statistics ( 2009a) were accessed online to obtain the proportion of patients dying from all causes. However, in the case of prisoners and offenders on probation (those receiving post-custodial supervision) the mortality rates were estimated using the data reported by Sattar G (2001). Sattar reported the death rates (per 100,000) for males 1996 and 1997 as 109.7 and 107.5 respectively.

**Table 9: Death by age range for prisoners (% of total deaths of prisoners)**

<b>Age group</b>	<b>Prisoners</b>
15-24	20.3
25-34	27.5
35-44	17.4
45-54	12.7
55+	22.0

**Table 10: Death by age range for offenders (post-custodial supervision as % of total deaths of prisoners)**

<b>Age group</b>	<b>Offenders</b>
15-24	29.4
25-34	35.6
35-44	16.1
45-54	11.5
55+	7.4

All costs and benefits are discounted by 3.5% (National Institute for Health and Clinical Excellence 2006).

Cost-effectiveness Ratios

Incremental cost-effectiveness ratios (ICER) measure the additional cost per QALY gained of Treatment A versus Treatment B:

$$ICER = \frac{\text{Cost Treatment A} - \text{Cost Treatment B}}{\text{Utility Treatment A} - \text{Utility Treatment B}}$$

## 5 Results

Results for different employment effectiveness are modelled in this assessment and are presented in this section. The results are presented in discounted and undiscounted incremental values, costs and QALYs.

<b>Table 11: Results using the effectiveness reported by Georgiades (2005)</b>				
	<b>Male</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£62,297	£34,274	58.07	23.33
No- TTS intervention	£274,906	£110,819	59.68	22.72
	<b>Female</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£38,807	£25,903	61.08	23.74
No- TTS intervention	£76,009	£49,728	60.68	23.36
	<b>All</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£101,104	£60,176	119.15	47.08
No- TTS intervention	£350,915	£160,547	120.36	46.09
	<b>Results Male</b>		<b>Results Female</b>	
		Discounted		Discounted
Incremental cost	- £212,608	-£76,546	-£37,202	-£23,825
Incremental QALY	-1.61	0.61	0.40	0.38
Incremental cost per QALY (ICER)	£132,067	-£125,317	-£93,217	-£62,683
	<b>Results All</b>			
		Discounted		
Incremental cost	- £249,810	-£100,371		
Incremental QALY	-1.21	0.99		
Incremental cost per QALY (ICER)	£206,325	-£101,292		

Table 11 presents the results obtained when running the model using the employment effectiveness reported by Georgiades (2005). The results suggest that TSSs interventions dominate no-intervention. This means that TSS costs less (in the long run) and accrues more benefits than no-TSS. The difference between the male

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ICERS and the female ICERs is mainly due to the difference in the number of males committing crimes.

<b>Table 12: Results using the effectiveness reported by Lemon, Hines, &amp; Merdinger (2005)</b>				
	<b>Male</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£80,119	£45,845	57.83	23.18
No- TTS intervention	£228,638	£75,107	60.29	23.19
	<b>Female</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£50,454	£33,851	60.94	23.64
No- TTS intervention	£42,722	£22,365	61.12	23.72
	<b>All</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£130,573	£79,696	118.77	46.82
No- TTS intervention	£271,360	£97,472	121.41	46.91
	<b>Results Male</b>		<b>Results Female</b>	
		Discounted		Discounted
Incremental cost	-	-	£7,732	£11,486
Incremental QALY	-2.46	-0.01	-0.18	-0.08
Incremental cost per QALY (ICER)	£60,402	£2,573,542	-£42,538	-£152,082
	<b>Results All</b>			
		Discounted		
Incremental cost	-	-		
Incremental QALY	-2.64	-0.09		
Incremental cost per QALY (ICER)	£53,316	£204,561		

The results obtained when using the employment effectiveness reported by Lemon, Hines, & Merdinger (2005) show that for males, although the discounted cost of TSS is much smaller (£45,845) than the discounted costs of no-TSS (£75,107) the discounted accrued benefits are smaller for TSS (23.18) than for no-TSS (23.19). In the females' case, the results suggest that no-TSS interventions are dominant. In other words, not having TSS costs less and accrues more benefits. This is due to the proportion of care leavers who gain employment in the no-TSS group (73.8%) reported by (Lemon, Hines, & Merdinger 2005) being higher than in the TSS group (58.4%).



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<b>Table 13: Results using the effectiveness reported by Lindsey &amp; Ahmed (1999)</b>				
	<b>Male</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£77,031	£44,232	57.87	23.20
No- TTS intervention	£246,333	£89,707	60.06	23.00
	<b>Female</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£48,647	£32,939	60.96	23.65
No- TTS intervention	£56,102	£34,045	61.07	23.62
	<b>All</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£125,677	£77,171	118.83	46.86
No- TTS intervention	£302,435	£123,752	121.13	46.62
	<b>Results Male</b>		<b>Results Female</b>	
		Discounted		Discounted
Incremental cost	- £169,302	-£45,475	-£7,455	-£1,106
Incremental QALY	-2.18	0.20	-0.12	0.04
Incremental cost per QALY (ICER)	£77,502	-£225,947	£63,889	-£30,042
	<b>Results All</b>			
		Discounted		
Incremental cost	- £176,757	-£46,581		
Incremental QALY	-2.30	0.24		
Incremental cost per QALY (ICER)	£76,812	-£195,660		

Table 13 shows the results obtained when running the model using the employment effectiveness reported by Lindsey & Ahmed (1999). The results suggest that TSSs interventions are expected to dominate no-TSS for both males and females. This means that TSS costs less and accrued more benefits than no-TSS intervention.

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<b>Table 14: Results using the effectiveness reported by Scannapieco, Schagrin, &amp; Scannapieco (1995)</b>				
	<b>Male</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£84,409	£49,156	57.77	23.14
No- TTS intervention	£262,179	£100,996	59.85	22.85
	<b>Female</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£53,540	£36,388	60.90	23.61
No- TTS intervention	£66,852	£42,201	60.80	23.46
	<b>All</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£137,949	£85,544	118.67	46.75
No- TTS intervention	£329,031	£143,197	120.65	46.31
	<b>Results Male</b>		<b>Results Female</b>	
		Discounted		Discounted
Incremental cost	- £177,770	-£51,840	-£13,313	-£5,813
Incremental QALY	-2.07	0.28	0.09	0.15
Incremental cost per QALY (ICER)	£85,779	-£181,944	-£144,139	-£39,194
	<b>Results All</b>			
		Discounted		
Incremental cost	- £191,083	-£57,653		
Incremental QALY	-1.98	0.43		
Incremental cost per QALY (ICER)	£96,503	-£133,074		

The results obtained when using the employment effectiveness reported by Scannapieco, Schagrin, & Scannapieco (1995) show that for both males and females TSS interventions are expected to dominate.

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<b>Table 15: Results using the effectiveness reported by Austin (1993)</b>				
	<b>Male</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£86,026	£50,404	57.75	23.12
No- TTS intervention	£254,514	£95,080	59.95	22.93
	<b>Female</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£54,703	£37,344	60.88	23.60
No- TTS intervention	£61,338	£37,668	60.87	23.52
	<b>All</b>			
	Total costs	Discounted total costs	Total QALY	Discounted QALY
TTS Intervention	£140,729	£87,748	118.63	46.72
No- TTS intervention	£315,853	£132,748	120.82	46.45
	<b>Results Male</b>		<b>Results Female</b>	
		Discounted		Discounted
	-			
Incremental cost	£168,488	-£44,676	-£6,635	-£324
Incremental QALY	-2.20	0.19	0.01	0.08
Incremental cost per QALY (ICER)	£76,759	-£234,019	-£1,234,080	-£4,192
	<b>Results All</b>			
		Discounted		
	-			
Incremental cost	£175,123	-£45,000		
Incremental QALY	-2.19	0.27		
Incremental cost per QALY (ICER)	£79,977	-£167,786		

Table 15 shows the results obtained when running the model using the employment effectiveness reported by Austin (1993). The results suggest that TSSs interventions dominate no-TSS for both male and female populations. It is important to bear in mind that Austin (1993) reported no statistically significant difference for employment status. Probabilistic sensitivity analysis may be necessary to account for the uncertainty on the effectiveness of employment.

**Probabilistic Sensitivity Analysis results**

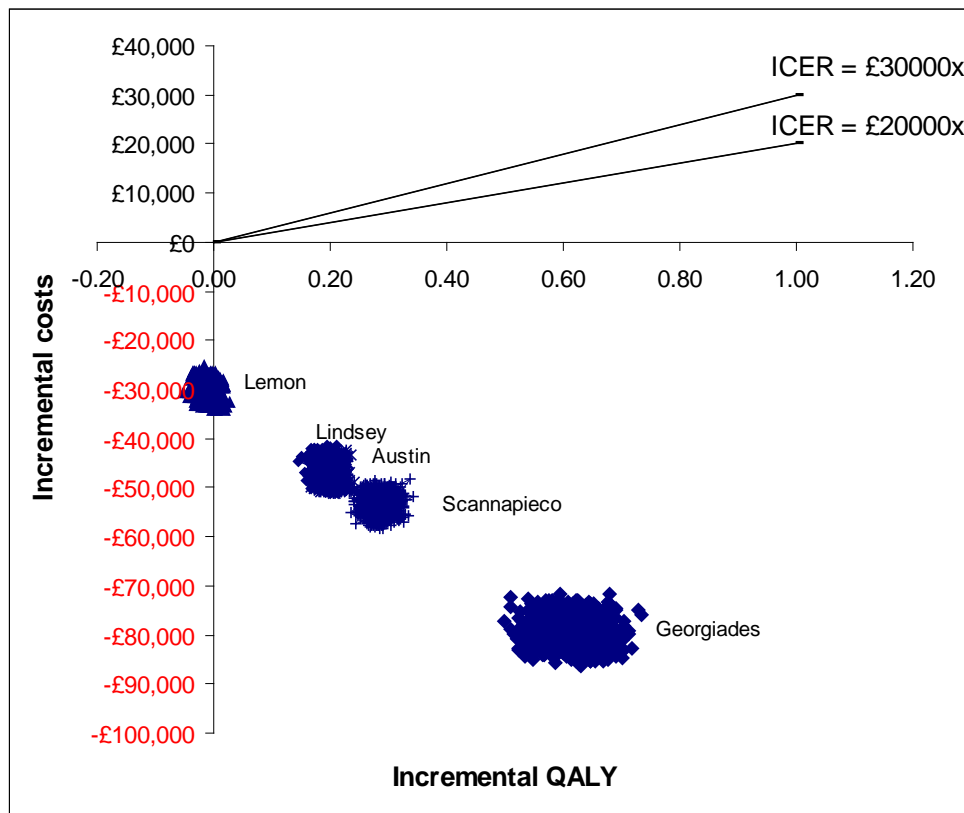
Comprehensive sensitivity analyses were undertaken to explore the joint uncertainty in model parameters on the cost-effectiveness of each intervention (Appendix 3). Monte Carlo sampling techniques (5,000 samples) were used to generate information

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on the probability that TSSs are optimal in terms of amount of net benefit. The results of the probabilistic sensitivity analyses are presented as scatter plots of incremental cost and incremental QALYs for the five studies identified by the systematic review (Georgiades 2005), (Lemon, Hines, & Merdinger 2005), (Lindsey & Ahmed 1999), (Scannapieco, Schagrin, & Scannapieco 1995) and (Austin 1993).

Figure 2 presents the probabilistic sensitivity analysis (PSA) for males including all the identified studies. From this figure, it can be concluded that TSS dominates no-TSS for (Georgiades 2005), (Lindsey & Ahmed 1999), (Scannapieco, Schagrin, & Scannapieco 1995) and (Austin 1993) studies. In the case of the study by (Lemon, Hines, & Merdinger 2005) for males, TSS dominates no-TSS in some cases and in other cases the QALYs gained are higher for no-TSS than TSS although the costs for TSS are smaller than those for no-TSS.

**Figure 2: Scatter plot of incremental QALYs and incremental costs for males**



From figure 3, it can be seen that in the females case TSS dominates no-TSS for (Georgiades 2005), (Lindsey & Ahmed 1999), (Scannapieco, Schagrin, & Scannapieco 1995) and (Austin 1993) studies. For the (Lemon, Hines, & Merdinger

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2005) study, the figure shows that in the female case no-TSS dominates TSS. This may be due to two factors: firstly, the proportion of care leavers employed in the no-TSS group is higher than in the TSS group; secondly, the number of crimes committed by females is much smaller than the crimes committed by males. This can affect the incremental cost-effectiveness ratios because having less crime reduce the total costs incurred by the Criminal Justice System and making no-TSS less costly than TSS.

**Figure 3: Scatter plot of incremental QALYs and incremental costs for females**

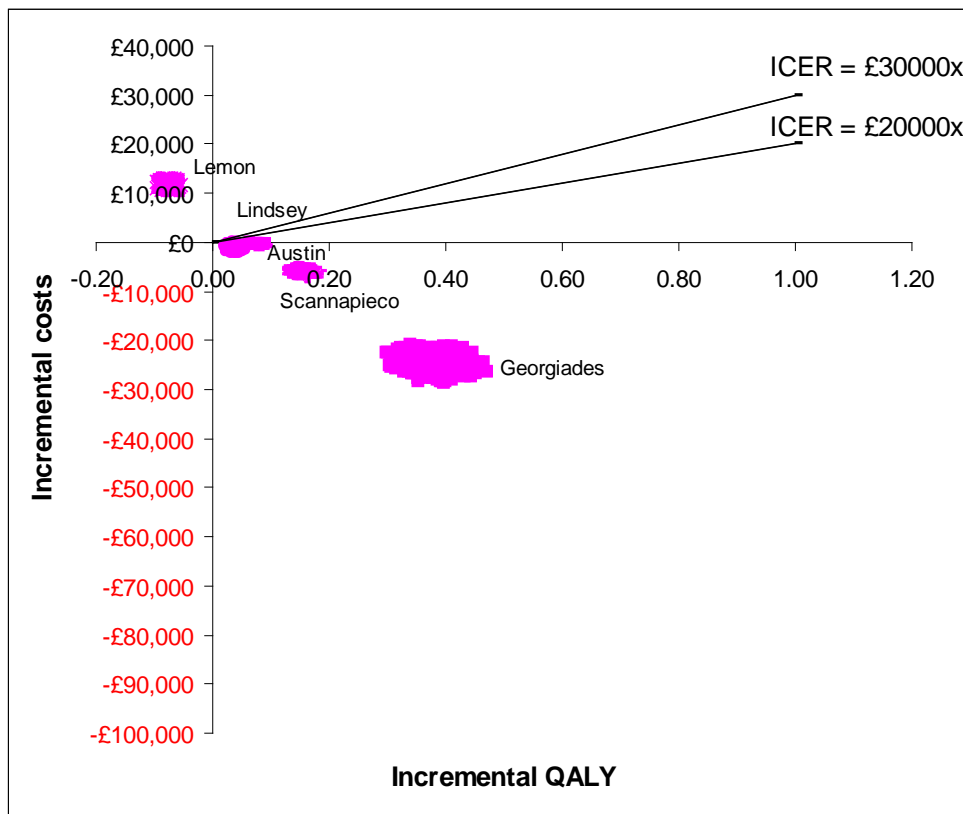
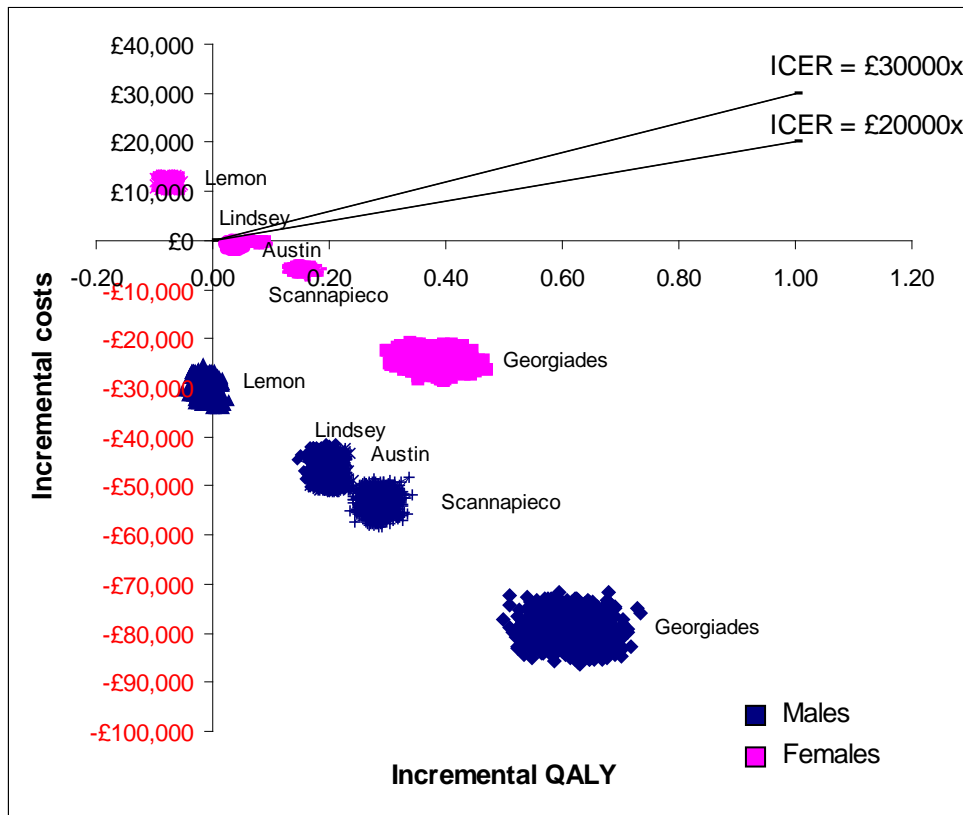


Figure 4 shows the male and female results for the PSA including the five identified studies. From this figure, it can be seen that TSS has a greater impact in males than in females due to the difference in the number of crimes committed by males. If TSS focuses on giving care leavers the necessary skills to find a job, the outcomes for both males and females can be positively affected and it is predicted that the number of crimes can be reduced. Thus, it has a direct impact in the resources used by the CJS and other services. In terms of health, the impact would be related to mental health outcomes (depression/anxiety), therefore having a direct impact in the QALYs gained.

Figure 4: scatter plot of incremental QALYs and incremental costs for males and females



## 6 Discussion

The results generated are sensitive to the gender of the young people leaving care, employment and crime. The majority of results are governed by the costs incurred by the Criminal Justice Services. The analyses demonstrate that TSS interventions for young people leaving care (compared to no-TSS interventions) can be cost-effective if the interventions focus on skills to find employment. Further research is required to allow inclusion of other adult outcomes such as education and housing.

Strengths – A mathematical model was constructed that allowed the analysis of the impact of TSS effectiveness over costs and benefits for young people leaving care. It was shown that TSS interventions dominate not having any TSS interventions both for male and female in most of the studies considered.

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Limitations – We were unable to find a link between education and employment. This could be considered for future work. However, this may not altered the results found. A number of assumptions were taken specifically when calculating the transition probabilities from unemployment to committing a crime and when calculating the costs of TSS interventions.

Uncertainties – It is unclear how much the effectiveness of TSS interventions can be generalised since all the studies used were conducted in a US setting. There was no clear definition of what TSS interventions should include. It is unclear whether the positive findings would be applicable to a UK setting.

The major uncertainties in this assessment relate to the probability of getting a job after leaving care. This has a major influence on the cost-effectiveness ratios as it was shown using the effectiveness from the Lemon, Hines, & Merdinger (2005) study. Considerable variation is present in another parameter of the study, i.e. cost of intervention (TSS). This parameter has major influence on the cost effectiveness estimates determining whether the TSS is dominant or cost effective.

## **7 Conclusion**

The availability of intervention effectiveness data to inform the cost-effectiveness modelling was limited (only five US studies).

The cost effectiveness results suggest that TSS interventions are expected to dominate no-TSS when the interventions focus on employment skills. Both young males and females will be less likely to commit a crime if they are employed. These interventions will also have an influence on health outcomes such as mental health specifically in the young females' case.

More studies assessing the effectiveness of TSS interventions compared to no-TSS are needed in the UK. These studies should record different outcomes such as education attainment, employment, crime, health and housing.

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**8 Appendices**

**Appendix 1**

**Search Strategy**

Number	Search	Databases	Limits?	Hits	Hits following removal of English Language and Duplicates	Hits following removal of obviously irrelevant references
\$\$ReviewOneEco1	((hous* or home*) and education* and outcome*).ti.	Medline and Econlit	No	18	16	16
\$\$ReviewOneEco2	((hous* or home*) and crim*).ti.	As above	1990-2009	55	54	52
\$\$ReviewOneEco3	((hous* or home*) and employment and outcome*).ti.	As above	No	7	6	6
\$\$ReviewOneEco4	((hous* or home*) and health and outcome*).ti.	As above	1990-2009	113	104	101
\$\$ReviewOneEco5	(education* and crime* and outcome*).ti,ab.	As above	1990-2009	89	80	80
\$\$ReviewOneEco6	(health and education and (outcome or link)).ti.	As above	No	23	18	18
\$\$ReviewOneEco7	(health and crime).ti	As above	1990-2009	57	52	45
\$\$ReviewOneEco8	(crime and employment).ti.	As above	No	24	18	18
\$\$ReviewOneEco9	(health and employment and (outcome* or link*)).ti.	As above	No	14	14	14



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Appendix 2

Evidence Table

Study	Country	N	Outcome		Outcome in TSS group (percent and number)	Outcome in no- TSS group (percent and number)	Significance (p-level)
Biehal (1995)	UK	74	Work/academic route career path		20%	43%	NR
Cook (1994)	USA	164	Completed high school				
			Maintained job >1 year				
			General satisfaction				
Georgiades (2005)	USA	67	No HS diploma or GED		16%	8%	
			HS diploma or GED		53%	15%	
			Employed full-time		22%	8%	ES=.53
			Employed part-time		51%	0%	
			Unemployed		27%	92%	
			Ever arrested		40%	83%	ES=.37
			Arrested for murder, assault, battery		24%	38%	
			Arrested for shoplifting, trespassing		24%	23%	
			Arrested for drug sale or DUI		32%	0%	
			Never homeless		85%	83%	ES=-.15
			Homeless for 1-3 nights		6%	0%	
			Homeless for >3 nights		9%	17%	
			Often depressed		39%	42%	ES=.03
			Sometimes depressed		28%	25%	
Never depressed		33%	33%				
Lemon	USA	216	Had a job immediately after		58.4% (45)	73.8% (79)	p<0.05

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Study	Country	N	Outcome	Outcome in TSS group (percent and number)	Outcome in no-TSS group (percent and number)	Significance (p-level)
(2005)			discharge			
			Ever had a problem with the law since discharge	12.3% (10)	15.9% (18)	NS
			Ever been without a place to sleep	16% (13)	23% (26)	NS
			Very happy with life these days	36.3% (29)	43.1% (47)	NS
			Somewhat happy with life these days	53.8% (43)	46.8% (51)	
			Not very happy with life these days	10% (8)	10.1% (11)	
			Very hopeful about the future	86.4% (70)	73% (81)	p<0.05
			Somewhat hopeful about the future	12.3% (10)	27% (30)	
			Not very hopeful about the future	1.2% (1)	0% (0)	
Lindsey (1999)	USA	76	Completed high school or GED	37%	18%	NS
			Employed full-time	41%	22%	NS
			Employed part-time	18%	22%	NS
			≥1 homeless episode	52%	53%	NS
Scannapieco (1995)	USA	90	High school graduate	50% (22)	13% (6)	NR
			History of employment (rate)	100% (44)	71.7% (36)	NR
			Employed at case closing	52.3% (23)	26.1 (12)	NR
Austin (1993)	USA	195	Unemployed at discharge	69%	75%	At discharge: Employment
			Employed part-time/summer/full-time at discharge	31%	25%	

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Study	Country	N	Outcome	Outcome in TSS group (percent and number)	Outcome in no- TSS group (percent and number)	Significance ( $p$ -level)
			Unemployed at 1 year	50%	63%	t status – NS Education – NS Public assistance – NS Parenthood – NS Living arrangement – NS Self-sufficiency index – NS Employment status – NS Education – NS Public assistance – NS Living arrangement – $p=0.01$ Self-sufficiency
			Employed part-time/summer/full-time at 1 year	50%	37%	
			Education – less than high school at discharge	56%	42%	
			Education – high school/GED/Vo-tech at discharge	44%	58%	
			Education – less than high school at 1 year	41%	21%	
			Education – high school/GED/Vo-tech at 1 year	59%	79%	
			Public assistance – yes at discharge	25%	25%	
			Public assistance – no at discharge	75%	75%	
			Public assistance – yes at 1 year	38%	29%	
			Public assistance – no at 1 year	63%	71%	
			Fathered/mothered child at discharge	28%	46%	
			Not fathered/mothered child at discharge	72%	54%	
			Living with parent/relative/foster parent/other at discharge	69%	87%	

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<b>Study</b>	<b>Country</b>	<b>N</b>	<b>Outcome</b>		<b>Outcome in TSS group (percent and number)</b>	<b>Outcome in no- TSS group (percent and number)</b>	<b>Significance (p-level)</b>
			Living by self/with friend at discharge		31%	13%	index – NS
			Living with parent/relative/foster parent/other at 1 year		50%	83%	
			Living by self/with friend at 1 year		50%	17%	
			Self-sufficiency index (public assistance + education completed + employment status + living arrangement) at discharge	Very dependent	13%	8%	
				Dependent	25%	38%	
				Dependent to independent	37%	29%	
				Independent	19%	25%	
				Very independent	6%	0%	
			Self-sufficiency index at 1 year	Very dependent	3%	4%	
				Dependent	19%	25%	
				Dependent to independent	41%	38%	
				Independent	28%	29%	
				Very independent	9%	4%	

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**Appendix 3**

**Effectiveness**

Variable description	Mean	Distribution	Lower	Upper	Source
<i>Intervention:</i>					
Employed full-time	0.22	Uniform	0.176	0.264	Georgiades (2005)
Employed part-time	0.51	Uniform	0.408	0.612	Georgiades (2005)
Unemployed					= 1-(Employed full-time+Employed part-time)
Currently in jail	0.02	Uniform	0.016	0.024	Georgiades (2005)
<i>Control:</i>					
Employed full-time	0.08	Uniform	0.064	0.096	Georgiades (2005)
Employed part-time	0	Uniform	0	0	Georgiades (2005)
Unemployed					= 1-(Employed full-time+Employed part-time)
Currently in jail	0.18	Uniform	0.144	0.216	Georgiades (2005)

**Costs**

Variable description	Mean	Distribution	Lower	Upper	Source
Average service costs in 2007 for people with depression (converted to 2009 prices)	£2,210	Uniform	£1,945 £21,49	£2,475 £27,36	McCrone et al. (2008)
Total cost per year for transition support services Process 8 (16+): Transition to leaving care services (converted to 2009 prices)	£24,429	Uniform	8	1	Calculated
Prison Costs for male local	£75	Uniform	£66	£84	ESRC Society Today (2009)
Prison Costs for female local	£116	Uniform	£102	£130	ESRC Society Today (2009)
Average Costs to CJS (immediate custody)	£12,625	Uniform	£11,11 0	£14,14 0	Brand & Price (2000)

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**Utilities**

Variable description	Distribution	Source
Utility Employment-Depression	Multinormal distribution using the covariance matrix of age, sex, employment, and depression	(National Centre for Social Research and University College London, 2008)

**Probabilities**

Variable description	Distribution	Source
Probability of employment by age	Multinormal distribution using the covariance matrix of age and sex	Singleton N et al. (2001)
Probability of anxiety/depression by employment status and sex	Multinormal distribution using the covariance matrix of age, sex, and employment	Singleton N et al. (2001)

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