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Primary care

Effectiveness of out-of-home day care for disadvantaged families: randomised controlled trial

Tami Toroyan, Ian Roberts, Ann Oakley, Gabrielle Laing, Miranda Mugford, Chris Frost

Abstract

Objective To assess the effects of providing daycare facilities for young children on the health and welfare of disadvantaged families.

Design Randomised controlled trial. Eligible children from the application list to a daycare facility were randomly allocated to receive a daycare place or not.

Setting Early Years daycare centre in Borough of Hackney, London.

Participants 120 mothers and 143 eligible children (aged between 6 months and 3.5 years).

Intervention A place at the centre, which provided high quality day care. Control families used other child care that they secured for themselves.

Main outcome measures Maternal paid employment, household income, child health and development.

Results At 18 months' follow up, 67% of intervention group mothers and 60% of control group mothers were in paid employment (adjusted risk ratio 1.23 (95% confidence interval 0.99 to 1.52)), but were no more likely to have a weekly household income of above £280 (risk ratio 0.88 (0.70 to 1.09)).

Intervention group children had more otitis media with effusion (risk ratio 1.74 (1.02 to 2.90)) and used more health services (1.58 (1.05 to 2.38)), but both estimates were imprecise.

Conclusion The provision of child day care may have increased maternal employment, but it did not seem to increase household income. The results suggest that providing day care may be insufficient as a strategy to reduce poverty. The study shows how random allocation can be used to ration and evaluate interventions where demand exceeds supply.

Introduction

Poor children are at increased risk for adverse health and social outcomes. In 2000, 4.5 million UK children were living in poor households (household income of less than 50% of the national average, excluding housing costs and adjusting for family size). Unemployment is an important cause of family poverty, and 20% of UK children live in a household with no one in paid work. Lone parents are particularly likely to be without paid work.

Reducing child poverty is a key government objective. Better access to out-of-home daycare facilities for children is considered to be an important anti-poverty strategy, since it might enable poor parents to take up paid work, thus increasing household income. It might also provide mothers with opportunities for further education, which could improve their future employment. However, there is little experimental evidence about the effects of day care on the lives of disadvantaged families.

Day care may have direct effects on the health of poor children. For example, by providing a safe environment for children, it may reduce injury rates. It can also have a beneficial effect on child development and behaviour: a systematic review of eight randomised controlled trials showed that day care improves child development and may reduce antisocial behaviour. On the other hand, there may be adverse health effects. Observational studies suggest that attendance at day care increases the risk of respiratory infection and otitis media with effusion. Prolonged otitis media with effusion can cause moderate hearing loss, which could delay a child's acquisition of language.

To evaluate the effects of providing high quality day care to disadvantaged families, we conducted a randomised controlled trial. In this paper we report the results of the trial for family and child outcomes (the process and economic evaluations that we also conducted will be reported separately).

Participants and methods

The trial was conducted at a new Early Years centre on the Holly Street Estate in the London Borough of Hackney. The demand for daycare places at the new centre greatly exceeded the number of places available, and, in response to a request from the trial team, the borough's education department agreed to use random allocation as the method of rationing places. Families living within the catchment area who had applied for a place at the centre for a child aged between 6 months and 3.5 years were invited to take part. All available places were randomly allocated, whether or not a family agreed to take part in the trial, and those who had consented to participate were followed up for 18 months.

Intervention

The intervention was high quality flexible day care for children under 5 years old. The quality of day care depends on several attributes, of which the integration
of care and education is particularly important. Unlike
standard nursery care in Hackney, the Early Years cen-
tre employed qualified teachers, and education was
integrated into the care of the children. The
integration of health and social services was also
encouraged. The centre was unusual in offering
parents full time or part time places, with the option to
change depending on circumstances. It also offered
extended care outside the normal nursery times for
working parents. The centre exceeded the national
requirements for other standard indicators of care
such as staff qualifications and staff to child ratios.

Independent assessments carried out with the early
care environments showed that the centre scored highly compared with others in
Britain. The centre was designated by the government
to be an “early excellence centre,” to act as a model of
good practice in childcare provision. Further details
about the centre are presented elsewhere.11

Control group families were expected to use a
range of childcare provision that they secured for
themselves, including other daycare facilities. However,
demand for daycare places in Hackney was greatly in
excess of supply, with about eight children for every
available place.12 We therefore expected that most of
the child care used by the control group would be part
time places at nursery schools (to which all children are
entitled after 3 years old) or care given by parents,
childminders, family, or friends.

Randomisation
The family was the unit of randomisation, and all chil-
dren in the same family were offered a place at the
Early Years centre. Most families were randomised at
the start of the trial, when the centre opened. Subsequently randomisation was conducted at inter-
vals when daycare places became available. The
intervention:control ratio varied between 1:1 and 1:2
according to the availability of places at the centre.

The allocation sequence was computer generated,
and we used minimisation to provide a reasonable bal-
ance on three potential confounders (size of family,
loneliness, and whether the application was for
a full fee paying or subsidised place). Eligible families
were given a unique family identification number, and
an independent statistician entered these numbers into
the minimisation software to determine which families
would be offered a place at the centre. The allocation
was sent to the centre, where administrative staff
matched the identification numbers with the corre-
sponding names and sent letters to the applicants
advising them of their allocation status.

Sample size
The primary outcome was maternal paid employment
at 18 months' follow up. On the basis of a feasibility
study, we estimated the baseline proportion of
employed mothers to be 40%.13 Economic studies have
suggested that day care may increase maternal paid
employment (full time and part time) by more than
25% (that is, from 40% to 65%).14,15 Data on supply and
demand of day care in Hackney at the start of the study
period led us to anticipate that it would be difficult for
control group families to find alternative daycare
facilities, and that the services they might find were
likely to provide short “sessional” day care that would
be incompatible with paid employment. Therefore, to
detect an effect of the size suggested by these studies
(25%), with a statistical power of 80% at α = 0.05, we
aimed to recruit 140 families.

Outcomes and data collection
Family outcomes—We asked mothers about paid
employment (in paid work or on maternity leave versus
not in paid work) and about hours per week in paid
work. We asked mothers to choose an income range
within which their weekly household income fell,
including take-home pay and benefits. We assessed
mothers’ psychological health using the general health
questionnaire 12, and we asked them if they had been
on educational courses in the previous six months, how
many close friends they had, and whether they smoked.

Child outcomes included mental development,
assessed with the Griffiths mental developmental
scales. We asked parents whether their children had
experienced any injuries in the previous month and
what infections their children had experienced in a one
week recall period. We recorded use of preventive
health services and immunisations at the final paedi-
tric assessments. We examined children’s ears at
18 months using a tympanometer to identify otiitis
media with effusion. Tympanograms were assessed
independently by two paediatricians. We also recorded
use of child care at 18 months.

At baseline, mothers completed questionnaires on
child and family outcomes, and the study paediatric-
ians collected data on child development. At nine
months’ follow up, we collected process and cost data
using questionnaires administered during interviews.
At 18 months’ follow up, we sent postal questionnaires
to participating families, and children were assessed by
a paediatrician who was not informed of their group
status. Data entry was blind to group allocation.

Statistical analysis
Analyses were on an intention to treat basis. An analy-
sis plan describing how each variable was to be
analysed was sent to the funding body before data
analysis. To increase precision and adjust for chance
imbalance at baseline, we used analysis of covariance to
adjust analyses of all follow up variables for the
baseline measurement of that variable, where this
information had been collected. Hours worked by
mothers at 18 months’ follow up were adjusted for a
binary variable indicating whether any hours had been
worked at baseline, since the exact number of hours
was not collected. Women who were on maternity leave
at baseline were considered not to have worked any
hours. We used generalised linear models with a log
link to estimate adjusted risk ratios for binary
outcomes. For child outcomes, we used the Huber-
White sandwich estimator of variance to obtain robust
standard errors that assume only that outcome
variables from different families are conditionally
independent. We used non-parametric bootstrap
confidence intervals (allowing for non-independence
of results from children in the same family) for highly
skewed continuous outcome and cost data. Analyses
were carried out in STATA (Stata Corporation, College
Station, Texas, USA).
have a household weekly income of above £200 (risk ratio 1.74 (1.02 to 2.96)) and were more likely to have visited a primary practitioner in the previous month (risk ratio 1.58 (1.05 to 2.38)), although the results are imprecise. Reliability of diagnosis of otitis media with effusion by the two paediatricians was high (κ = 0.96).

Use of daycare facilities
The mean time that children in the intervention group attended the daycare centre over the study period was 211 days. At the end of follow up, 92% (57/62) of the intervention group children were in some type of centre based day care (including attendance at a local authority, community, or private nursery or at a nursery unit attached to a school) compared with 63% (47/75) of control group children. Of these 47 control group children in formal day care, 23 (49%) were attending a nursery unit attached to a local authority school (see table 4). Unlike the care offered by local authority, community, or private nurseries, nursery units attached to schools offer only part time day care, usually a 2.5 hour morning session or a 2.5 hour afternoon session. No extended day care or holiday care is provided.

Discussion
A higher proportion of mothers in the intervention group were in paid employment than in the control group mothers, but the effect estimates were imprecise and the results are compatible with chance. Intervention group mothers worked more hours than control group mothers, but again the estimates were imprecise. Despite the trend towards more paid employment, there was no evidence that intervention mothers had a higher household income. Children in the intervention group were more likely to have otitis media with effusion and to have used more health services.

Strengths and weaknesses of study
Allocation was well concealed, and follow up rates were high (95%). Participants provided outcome data with self completed questionnaires, and the researchers who collected and entered the data were blind to the participants’ allocation status. At the paediatric

Table 1 Baseline characteristics of mothers and children according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

<table>
<thead>
<tr>
<th>Mothers</th>
<th>Intervention group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers completed baseline questionnaire</td>
<td>n=49</td>
<td>n=61</td>
</tr>
<tr>
<td>In paid employment (part time or full time)</td>
<td>25/47 (54)</td>
<td>36/69 (54)</td>
</tr>
<tr>
<td>Mean (SD) age when left full time education (years)</td>
<td>19.2 (4.0)</td>
<td>19.5 (3.3)</td>
</tr>
<tr>
<td>Mean (SD) age (years)</td>
<td>31.4 (6.1)</td>
<td>32.2 (5.4)</td>
</tr>
<tr>
<td>Total weekly household income &gt;£200</td>
<td>19/45 (42)</td>
<td>21/56 (38)</td>
</tr>
<tr>
<td>Claiming means tested benefit*</td>
<td>30/48 (61)</td>
<td>30/81 (49)</td>
</tr>
<tr>
<td>Non-white ethnicity</td>
<td>28/47 (60)</td>
<td>38/60 (63)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>10/48 (21)</td>
<td>15/61 (25)</td>
</tr>
<tr>
<td>Mean (SD) general health questionnaire 12 score</td>
<td>11.9 (5.9)</td>
<td>12.7 (4.4)</td>
</tr>
<tr>
<td>Living with partner</td>
<td>23/47 (49)</td>
<td>34/59 (58)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Children</th>
<th>Intervention group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers completed baseline questionnaire</td>
<td>n=62</td>
<td>n=72</td>
</tr>
<tr>
<td>Mean (SD) age (months)</td>
<td>25.5 (10.1)</td>
<td>25.7 (18.2)</td>
</tr>
<tr>
<td>Mean (SD) birth weight (g)</td>
<td>3200 (600)</td>
<td>3300 (500)</td>
</tr>
<tr>
<td>Mean (SD) quotient for Griffiths mental developmental scales</td>
<td>106.6 (19.0)</td>
<td>101.7 (18.6)</td>
</tr>
</tbody>
</table>

*Income support, job seekers’ allowance, housing benefit.
which randomisation was possible because of the need to ration the available daycare places. Although the educational authority agreed to the use of random allocation as the rationing method, we were constrained in the number of places that we could offer within the project timeframe.

At the outset we understood that 70 places would be available when the daycare centre opened, with the possibility of more places becoming available later. However, during the study it became apparent that there were fewer places than anticipated, and only 64 daycare places were eventually allocated. Hackney is highly disadvantaged and has a large refugee population, and some places at the centre were reserved for families in emergency situations and for referrals from social services. The need to keep some places available to ensure flexibility to accommodate families’ changing requirements for daycare care also meant that the centre was never running at its maximum capacity. Lastly, the need to implement the local policy that children in the same family should be offered a place at the same daycare facility resulted in a lack of independence of child outcome data, which also reduced power.

At 18 months’ follow up, many children in the control group were using some type of centre based day care facilities in Hackney with long waiting times, which randomisation was possible because of the need to ration the available daycare places. Although the educational authority agreed to the use of random allocation as the rationing method, we were constrained in the number of places that we could offer within the project timeframe.

Table 3
Maternal and family outcomes at 18 months’ follow up according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Control</th>
<th>Point estimate* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In paid employment (part time or full time)</td>
<td>33/49 (67)</td>
<td>39/65 (60)</td>
<td>RR 1.23 (0.99 to 1.52)</td>
</tr>
<tr>
<td>Mean (SD) hours worked in previous week</td>
<td>14.8 (17.8)</td>
<td>11.4 (15.5)</td>
<td>MD 5.75 (2.00 to 13.75)</td>
</tr>
<tr>
<td>In education in previous 6 months</td>
<td>18/49 (37)</td>
<td>24/65 (37)</td>
<td>RR 0.99 (0.66 to 1.52)*</td>
</tr>
<tr>
<td>Total weekly household income ≥£200</td>
<td>21/49 (43)</td>
<td>52/64 (50)</td>
<td>RR 0.88 (0.70 to 1.06)</td>
</tr>
<tr>
<td>Claims means tested benefit</td>
<td>29/49 (51)</td>
<td>34/65 (52)</td>
<td>RR 0.95 (0.71 to 1.27)</td>
</tr>
<tr>
<td>Has tenure (owns or part owns housing)</td>
<td>15/49 (31)</td>
<td>20/65 (31)</td>
<td>RR 0.99 (0.67 to 1.58)</td>
</tr>
<tr>
<td>Health in previous month good</td>
<td>39/49 (80)</td>
<td>52/65 (80)</td>
<td>RR 1.02 (0.86 to 1.23)</td>
</tr>
<tr>
<td>Mean (SU) general health questionnaire 12 score</td>
<td>10.8 (5.2)</td>
<td>10.8 (6.0)</td>
<td>MD 0.10 (−0.16 to 2.35)</td>
</tr>
<tr>
<td>Used medication for depression in previous week</td>
<td>3/49 (6)</td>
<td>4/65 (6)</td>
<td>RR 0.99 (0.23 to 4.24)*</td>
</tr>
<tr>
<td>Current smoker</td>
<td>14/49 (29)</td>
<td>19/65 (29)</td>
<td>RR 0.97 (0.75 to 1.24)</td>
</tr>
<tr>
<td>Has many close friends</td>
<td>5/49 (10)</td>
<td>13/65 (20)</td>
<td>RR 0.51 (0.19 to 1.34)*</td>
</tr>
<tr>
<td>Receives help from family</td>
<td>29/49 (59)</td>
<td>39/65 (60)</td>
<td>RR 0.99 (0.73 to 1.34)*</td>
</tr>
</tbody>
</table>

*Risk ratio (RR) for binary outcomes, mean difference (MD) for continuous outcomes. Point estimates are adjusted for baseline values. Where baseline information on variable was not collected, unadjusted estimates are shown and are marked with an asterisk.
† Bootstrap 95% CI to correct for bias.

Table 4
Children’s use of child care at 18 months’ follow up according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

<table>
<thead>
<tr>
<th>Type of day care</th>
<th>Intervention group (n=62)</th>
<th>Control group (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre based care</td>
<td>57 (92)</td>
<td>47 (64)</td>
</tr>
<tr>
<td>Community nursery</td>
<td>1 (2)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>Private nursery</td>
<td>4 (6)</td>
<td>7 (9)</td>
</tr>
<tr>
<td>Local authority nursery</td>
<td>43 (69)</td>
<td>13 (17)</td>
</tr>
<tr>
<td>Nursery unit attached to local authority school</td>
<td>9 (15)</td>
<td>23 (31)</td>
</tr>
<tr>
<td>By family</td>
<td>8 (15)</td>
<td>10 (13)</td>
</tr>
<tr>
<td>By friends or relatives</td>
<td>4 (6)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>By childminder</td>
<td>6 (10)</td>
<td>15 (20)</td>
</tr>
</tbody>
</table>

The main study weakness is the lack of power because of our inability to achieve a sufficiently large sample size. This was an opportunistic evaluation of an anti-poverty strategy in a deprived inner city setting in which resources, some parents talked about their childcare arrangements, and so we cannot exclude the possibility of bias in the assessment of child development. However, such a bias is unlikely for the results for otitis media, as the two paediatricians examined the printed tympanograms without any identifying information. Although the ratio of intervention to control families varied over the course of recruitment, this is unlikely to have resulted in bias since the availability of daycare places is not expected to have been related to any outcome variable.

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most of the centre based day care available to control children was at school nursery units offering part time day care without the flexibility needed to allow for maternal employment. None the less, the fact that many control children did receive formal day care would have resulted in smaller intervention effects than if the control group had had no day care.

**Relationship of the data to other studies**

There is little experimental evidence on the effects of child day care on maternal employment and no randomised controlled trials in the United Kingdom. Although our results suggest an increase in paid employment among intervention mothers, the lack of evidence of a corresponding increase in household income may reflect the fact that wages are low for jobs for which mothers in Hackney are eligible. Furthermore, women who enter paid employment or who increase their hours of paid work may experience a reduction in their entitlement to welfare benefits, such as housing benefit or working families' tax credit. Our results support findings from other studies that suggest that mothers’ decisions to enter the labour market may not be motivated solely by immediate financial returns. Instead, there may be other benefits, such as maximising long term earning potential, relief from full time child care, or job satisfaction.17 18 Similar effects of day care on paid employment and household income may be expected in other disadvantaged areas of Britain, where unemployment is high and there is a large unmet need for daycare facilities. However, the extent to which these results are generalised to less deprived areas is open to question.

Our results are consistent with observational studies in showing that daycare attendance increases the risk of otitis media with effusion, although we found no evidence of delay in language acquisition or behavioural problems. Observational studies have also shown that day care increases the risk of infection, but we found no evidence of this, although we did find a suggestion of greater use of health services. An objective of the Early Years centre was to integrate children’s care with health services, and preventive health care was actively encouraged. However, we found no effect on the use of preventive health services, as measured by immunisation status and uptake of child health promotion reviews, although this may have resulted from a lack of study power. We were unable to determine whether the increase in health service use we found was due to greater illness or to greater use of preventive or routine services that were not detected.

**Policy implications and future research**

This trial provides some support for government initiatives based on the belief that daycare provision can increase maternal employment. However, our results question the assumption implicit in many such initiatives—that paid employment provides an immediate route out of poverty by increasing household income. Tackling low pay, changing the benefit structure, and reducing the costs of day care to poor families may be equally important components of an anti-poverty strategy. Although this was a small trial, it shows that evaluation of anti-poverty interventions is possible in situations where the demand for the intervention exceeds supply and the intervention must be rationed.19

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**What is already known on this topic**

Reducing poverty in families with children is a key government objective. Daycare provision is considered essential to reducing family poverty because it allows mothers with young children to enter paid employment.

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**What this study adds**

This randomised controlled trial found that daycare provision increased maternal paid employment but found no evidence that this increased maternal family income.

In addition to providing daycare places, policies to reduce family poverty must also tackle low pay and the benefit structure.

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