WHERE DOES A MOTHER’S DAY GO?
PRELIMINARY ESTIMATES FROM THE
AUSTRALIAN TIME USE SURVEY OF NEW
MOTHERS

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Preliminary estimates from the Australian
Time Use Survey of New Mothers

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INTRODUCTION

This paper addresses an issue that is poorly addressed by existing data collections and analyses of infant health and nutrition – How does a new mother use her time with the infant?

There is increasing recognition that time is a resource, and that its allocation has important economic implications. This is reflected, for example, in public debate and discussion on work-family balance. As households, mainly women, increasingly shift their time from unpaid work to paid work, resources are shifted away from the care economy to the market economy. This trend has been described by economist Nancy Folbre as the shrinking of the mythical ‘Magic Pudding’, the largely invisible sphere of women’s unremunerated care work which underpins the functioning of the market economy (Folbre 2002).

Although economic analysis often assumes that household production and care is determined by non-economic or altruistic motives, and is – like the Magic Pudding – an infinite resource, it is becoming clearly evident that the supply of care is responsive to market incentives. As the economic opportunity cost of providing care increases, this supply will ultimately dry up. This has important implications for the future cost of public services, such as childcare and elder care, and makes it of increasing importance for policy design and programs to account for time. Rising rewards in the labour market have not been matched by recognition of women’s unpaid care work, and a significant financial penalty attaches to women engaged in care work. This ‘care penalty’ is now heavily reinforced in Australia and other countries by a shift to retirement income policies based on earnings-related private superannuation or pensions.

Rising employment opportunities for women have seen substantial increases in labour force participation rates of married women with children, including infants (Baxter 2005). Although labour force participation rates among mothers with infants is lower than in the United States, this could have important implications for the health and development of Australian infants. For example, growing evidence from the United States and elsewhere (Tanaka 2005) is that full time maternal employment in the first year after birth may have adverse implications for child health and development, including through reducing breastfeeding and immunisation rates (Berger, Hill and Waldfogel 2005).

Likewise, the declining birth rate and aging population structure presents significant problems for economic and fiscal policy. Resolving this will require better understanding of the time costs to women of bearing, nursing and raising the nation’s future citizens and workers.

Developing policies and practices which deal with these competing demands of the care- and market economies on women’s time requires specific understanding of how time is allocated when time pressures are greatest, in the year after a baby is born.

Current time use surveys provide inadequate information on women’s unpaid care work. Women’s time ‘at call’ and in ‘passive childcare’ activities is typically underestimated and thereby undervalued, so that time resources that women have at their disposal are overestimated (Folbre et al. 2005). This is particularly so for women with infants. Although the presence of a newborn in a family is very time-intensive, national time use data focusing on new mothers’ time use is rarely collected.
The Australian Bureau of Statistics (ABS) Time Use Survey (TUS) collects nationwide data on time use (Australian Bureau of Statistics 1997). Using this data, Craig (2004) has investigated the impact of children on adult time using TUS data, providing more detail than previously available including, for example, analysis of how the age of the youngest child affects parental time use.

However while having a number of major strengths, the TUS has limitations in investigating young families and early childhood. In particular, the TUS data relates to just 705 couple households with children (2926 diary days). Even fewer have a child under 5 years of age (1690 diary days). Also, the TUS is cross sectional, measuring time use at a single point in time, whereas longitudinal data is needed to capture the rapid changes occurring in a family during the first year with a new baby.

Because of its broad purposes, the TUS does not collect information of specific relevance to early childhood health and development such as infant feeding method or maternity leave entitlements. Such factors may have an important bearing on parental labour force participation and time use patterns, and have important implications for future health and development of mother and child.

The intensive time and other demands of an infant on its mother also present particular research design and measurement issues. The impact of an infant on a mother’s available time is not well measured or understood.

This study aimed to fill such gaps in the ABS data collection regarding the time use of mothers and infants, and identify key research design issues with this demographic group. We will also document the key features and trends in the time use of mothers in the months after birth. The study is also intended to illustrate the unique value for policy and social and economic research of regular ABS surveying of new parents as part of an ongoing program of time use surveys.

The nationwide Time Use Survey of New Mothers (TUSNM) commenced at the Australian National University in 2005. This paper will outline the TUSNM methods, and present preliminary findings.

Results so far highlight questions of how to measure and evaluate ‘pre-emptible’ time, and the extent of multitasking. Findings also raise questions about how the heavy time demands of emotional care and infant feeding activities shape parental decisionmaking regarding infant care, and how this affects future infant health and development, as well as maternal well-being.

THE TIME USE SURVEY OF NEW MOTHERS

The Time Use Survey of New Mothers is a cross sectional survey design but with a nested longitudinal component. It collected quantitative and qualitative data from participants using conventional questionnaire methods as well as innovative electronic tracking of time use.

Mothers gave written informed consent to the study before enrolment in accord with ANU ethical approval under National Health & Medical Research Council guidelines.
Recruitment and sample

Recruitment of participants was throughout Australia, through advertisements placed in the newsletters of mothers’ organisations such as the Playgroups Association and the Australian Breastfeeding Association. Fliers were also distributed to maternal and child health professional networks, infant health clinics, and commercial and not for profit childcare centres. Media coverage in the ACT also generated a number of enquiries.

A total of 188 new mothers enrolled in the study.

Questionnaire data collection

A questionnaire collecting data on family and socio-demographic and employment-related details at the time of each tracking session was sent by mail to the mother along with the TimeCorder, within two weeks of the 3 month, 6 month or 9 month anniversary of the infant’s birth (see Appendix A). For premature infants, corrected aged was used.

The questionnaire collected data on variables such as:

- Family size and characteristics (number of children under 14; age of youngest and second youngest; couple or single parent)
- Maternal characteristics (age; education level; current employment status; usual occupation; maternity leave entitlement; paid or unpaid leave access; intentions regarding return to work before 12 months)
- Residence (State or Territory; capital city, other urban, rural)
- Family income and earnings (annual income; hourly earnings of mother and father; usual employment hours of father)
- Infant feeding method (past 24 hours, past 7 days: exclusive breastfeeding; exclusive formula feeding; mixed - milk only; breastmilk/solids; formula milk/solids; breastmilk/formula milk/solids)
- Non-maternal care hours (other household members; paid childcare services,)
- Maternal time without childcare responsibilities (infant; other children)

There was also an open question and an invitation to participants to comment on their participation in the survey.

While the mother was asked questions about the number of hours that someone else was feeding or caring for the infant, the number of hours that she did not have care of the infant, and the number of hours she did not have the main responsibility for either infant or other children, this is the only data collected regarding the unpaid work of husbands.

The survey data thus excludes husbands’ unpaid housework and some joint childcare or infant care.

In total, 366 questionnaires were collected from the participants at the time of each of their tracking sessions. Some mothers providing time tracking data did not return a completed questionnaire for that session, while some mothers completing a questionnaire did not generate usable time tracking data.
Time use data collection

The conventional methods of conducting time use surveys are through diaries, or direct observation. The ABS uses the diary collection method in its survey, as does the time use component of the Longitudinal Survey of Australian Children (LSAC).

However, as we specifically wanted to study the time use of new mothers, it was felt that using the diary method potentially placed an unacceptable demand on the time of new parents. Likewise, direct observation, was both costly and excessively intrusive.

Instead this study used an electronic device, the TimeCorder, which is Canadian technology of workplace productivity consultant, Pace Productivity (Figure 1). The device is battery operated, and the data is downloaded onto a computer when the participant has returned it after tracking.

Figure 1 The TimeCorder – time tracking device

The TimeCorder was mailed to mothers along with instructions on operation and a ‘helpline’ for any queries on operating it. Participants were asked to turn the TimeCorder on for the whole 7 days, and press the appropriate button to record their activities each time they changed activity. The device was then posted back to the researchers for downloading of data.

The advantages of using an electronic tracking method were that it:

- facilitates recruitment, as participation is less demanding
- minimises demands and intrusions on the mother-infant pair at a vulnerable time
- cheaper than direct observation
- less data entry as downloaded directly from the device

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1 For more information on the TimeCorder and its use in workplace research by Pace Productivity see [www.getmoredone.com](http://www.getmoredone.com).
generates high quality data with large number of daily events recorded.

On the other hand, it had the disadvantage that it was;

- more difficult to measure multitasking
- participants needed instruction in use
- risk of device failure
- risk of device loss and data loss during mailing or download

Each of 27 buttons on the TimeCorder device was programmed for a different activity, including one ‘miscellaneous’ button. The device records the number and duration of events.

The ‘time stamp’ program in the TimeCorder also records the time and date of each activity and generates a separate downloadable file. The time and date parameters can be adjusted for example, to accommodate time differences between tracking locations.

For example, during this survey, some mothers were tracking in WA which is 3 hours behind Eastern Standard Time. Data downloaded from such participants was adjusted so that the timing of activities reflected their local time and dates, rather than Eastern Standard Time which applied when it was downloaded. The time stamp data for participants in various Australian time zones is thus comparable with participants in New South Wales, tracking on Eastern Standard Time or Eastern Summer Time, as the case may be.

Data was also adjusted for differences in the timing of daylight saving in various Australian states and territories.

Further information on the TimeCorder is at Appendix, and on the time stamp data is at Appendix C.

**Time tracking design**

As mothers generally tracked for a full seven days, results will control for the day of the week. Approximate seasonal control was achieved by the study covering a full year, from April 2005 to April 2006.

An important design consideration was to ensure compatibility and facilitate comparison with official surveys, such as the TUS. Hence, the activities were developed to align with the major categories of activity used by the ABS in the TUS. Additional sub-categories were created within these major categories to reflect the particular nature of new mothers’ activities. This was based on a review of other studies of time use of new mothers (see ‘Feeding Related Activities’ below), and previous experience with a Canadian survey of mothers (Ellwood 2002).

The activities programmed into the TimeCorder and recorded in the study are set out in Table 1 below.
Table 1: Activities recorded by participants

<table>
<thead>
<tr>
<th>TimeCorder Code</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sleeping and napping</td>
</tr>
<tr>
<td>B</td>
<td>Sleeplessness</td>
</tr>
<tr>
<td>C</td>
<td>Eating, drinking alone</td>
</tr>
<tr>
<td>D</td>
<td>Other personal care</td>
</tr>
<tr>
<td>E</td>
<td>Employment</td>
</tr>
<tr>
<td>F</td>
<td>Education re breastfeeding</td>
</tr>
<tr>
<td>G</td>
<td>Other education</td>
</tr>
<tr>
<td>H</td>
<td>Domestic</td>
</tr>
<tr>
<td>I</td>
<td>Meals with kids, other adults present</td>
</tr>
<tr>
<td>J</td>
<td>Bath, dress, change kids</td>
</tr>
<tr>
<td>K</td>
<td>Meals with kids alone</td>
</tr>
<tr>
<td>L</td>
<td>Prepare infant feed</td>
</tr>
<tr>
<td>M</td>
<td>Breastfeed or give expressed</td>
</tr>
<tr>
<td>N</td>
<td>Feed formula from bottle</td>
</tr>
<tr>
<td>O</td>
<td>Carry, hold, soothe</td>
</tr>
<tr>
<td>P</td>
<td>Nurse unwell infant</td>
</tr>
<tr>
<td>Q</td>
<td>Teaching kids to eat</td>
</tr>
<tr>
<td>R</td>
<td>Play, read, talk to kids or teach</td>
</tr>
<tr>
<td>S</td>
<td>Minding and supervision</td>
</tr>
<tr>
<td>T</td>
<td>Travel to feed baby</td>
</tr>
<tr>
<td>U</td>
<td>Other child care</td>
</tr>
<tr>
<td>V</td>
<td>Purchase kids medical</td>
</tr>
<tr>
<td>W</td>
<td>Purchase other goods services</td>
</tr>
<tr>
<td>X</td>
<td>Volunteering</td>
</tr>
<tr>
<td>Y</td>
<td>Social</td>
</tr>
<tr>
<td>Z</td>
<td>Recreation, TV, leisure</td>
</tr>
</tbody>
</table>

Each of the activities of mothers which were tracked by the TimeCorder can be allocated to categories used by the ABS TUS (Australian Bureau of Statistics 1997):

- Personal care
- Employment
- Education
- Domestic activities
- Childcare
- Purchasing goods and services
- Voluntary work and care
- Social and community interactions
- Recreation and Leisure

This is an internationally accepted method of presenting time use data that also accords with four logical typologies of time (necessary time, contracted time, committed time and free time) (Aas 1982; Australian Bureau of Statistics 1997). Table 2 below compares these categories with the ABS TUS categories:
**Table 2 Activity categories for the Australian TUS and the TUSNM**

<table>
<thead>
<tr>
<th>ABS TUS Activity Category</th>
<th>TUSNM Main Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal care</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td></td>
<td>Other personal care</td>
</tr>
<tr>
<td></td>
<td>Sleeping and napping</td>
</tr>
<tr>
<td>Sleeplessness</td>
<td></td>
</tr>
<tr>
<td>Eating, drinking alone</td>
<td></td>
</tr>
<tr>
<td>Meals with kids alone</td>
<td></td>
</tr>
<tr>
<td>Meals with kids, adults present</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Employment</td>
</tr>
<tr>
<td></td>
<td>Other education</td>
</tr>
<tr>
<td>Education</td>
<td>Education re breastfeeding, formula prep</td>
</tr>
<tr>
<td>Domestic activities</td>
<td>Domestic</td>
</tr>
<tr>
<td></td>
<td>Bath, dress, change, teeth (physical care)</td>
</tr>
<tr>
<td></td>
<td>Carry, hold, soothe infant (emotional care)</td>
</tr>
<tr>
<td></td>
<td>Child care other</td>
</tr>
<tr>
<td></td>
<td>Minding</td>
</tr>
<tr>
<td></td>
<td>Nurse, sooth, medicate unwell infant</td>
</tr>
<tr>
<td>Child care</td>
<td>Play, read, talk to children or teach</td>
</tr>
<tr>
<td></td>
<td>Breastfeeding or give expressed milk</td>
</tr>
<tr>
<td></td>
<td>Feed formula from bottle</td>
</tr>
<tr>
<td></td>
<td>Prepare infant formula</td>
</tr>
<tr>
<td></td>
<td>Teaching eating</td>
</tr>
<tr>
<td></td>
<td>Travel to feed baby</td>
</tr>
<tr>
<td>Purchasing goods and services</td>
<td>Purchasing</td>
</tr>
<tr>
<td></td>
<td>children’s medical services,</td>
</tr>
<tr>
<td>Voluntary work and care</td>
<td>Volunteering</td>
</tr>
<tr>
<td>Recreation, fitness, leisure</td>
<td>Recreation, television, leisure</td>
</tr>
<tr>
<td>Social and community interactions</td>
<td>Social</td>
</tr>
</tbody>
</table>

The study has been designed so that activities can also be easily allocated to categories used in the Pace Productivity study of mothers (Ellwood 2002).

Participants were told that in allocating activities, the main consideration was the purpose of the activity, and that their choice should reflect their view of the purpose of the activity. For example, if the main purpose of walking was to soothe the baby, it should be categorised as that. If it was mainly intended for the mothers’ physical well being, then it should be counted under personal care or recreation, depending on how the participant viewed it. Likewise,
travel was counted against the purpose of the travel, so travel to the shops would be recorded under shopping.

These instructions were conveyed to participants in the instruction sheet sent with the device for each tracking session, and in advice provided in response to phone or email queries.

**Feeding related activities**

An important activity for new mothers is of course infant care, a major element of which is feeding. Health authorities recommend infants be exclusively breastfed to 6 months with continued breastfeeding to at least 12 months (American Academy of Pediatrics 2005; National Health and Medical Research Council 2003) or two years and beyond (World Health Assembly (Fifty Fourth) 2001).

Until now, data did not exist to evaluate the relative time costs and values for different infant feeding methods. Only a very limited number of studies have compared the time associated with different infant feeding methods (Popkin et al. 1984), and these studies are all for developing countries. These may thus have limited applicability to developed countries such as Australia. While some studies, for example, Popkin and colleagues (1984) conclude breastfeeding is time intensive, this conclusion is not universally accepted (e.g. (Greiner, Almroth and Latham 1979, p. 38; Rohde 1982).

A number of conceptual and measurement issues arise in design of such studies, including problems in defining breastfeeding and feeding time, and distinguishing feeding from other childcare activities.

Firstly, there are problems defining time spent “feeding”. Virtually all surveys measure “feeding” as time holding the baby but especially in developed countries, different infant feeding methods may be associated with different parenting styles or practices. For example, many breastfeeding mothers offer the breast for comfort as well as nutrition. Many breastfeed their baby to sleep. The breastfeeding mother would be measured as spending more time “breastfeeding”, but she may spend less time on other childcare activities – “settling baby”, “soothing” a fractious child. Comparisons of the time-intensity of breastfeeding may be thereby distorted.

The likelihood of “joint production” or multi-tasking is also a problem for comparisons of time spent breastfeeding or bottle-feeding. Breastfeeding is often compatible with simultaneous undertaking of other tasks. Night feeds and sleeping are important examples of joint production as breastfeeding may occur with less disturbance to the mother's sleep than for artificially fed infants. This “joint production” is less possible with artificial feeding. (Greiner, Almroth and Latham 1979; Popkin 1978). Most studies do not specify whether observations are limited to daylight hours, yet a substantial part of breastmilk intake and feedings occur at night (Greiner, Almroth and Latham 1979, p. 19).

By not breastfeeding, mothers may be better able to share the feeding and care of the infant and save time for themselves. That is, the time costs of infant care may be redistributed from the mother to others within the family or outside the family.

Mothers using artificial formula milk also introduce solids earlier (Hitchcock and Coy 1988; Lilbourne et al. 1989). This also gives misleading comparisons of time spent on different
feeding methods as most researchers assume artificially feeding mothers and breastfeeding mothers spend equal time feeding solids.

Then there is the question of what costs to include. Some studies only include direct time costs (that is actually feeding or holding the baby). However, preparation and sterilisation costs are significant for artificial feeding. Some mothers save time by propping the baby up with the bottle rather than holding it to feed, although this practice is not recommended by health professionals for infants. With increasing evidence of higher illness in artificially fed infants in developed countries such as Australia, additional time spent nursing a sick infant, including seeking and receiving medical assistance should also be counted as a time cost of artificial feeding. On the other hand, some researchers include time breastfeeding mothers spend preparing extra food, or in breast and nipple care, or in learning breastfeeding.

Another key issue is whether paid employment is incompatible with breastfeeding, or whether the possible loss of employment opportunities is a cost of having a baby. Levine and Huffman (1990) and Meershoek (1993) list possible loss of mothers’ employment opportunities as a cost of breastfeeding. Butz (Butz 1978; 1981) suggests urbanisation brings increased opportunities for mothers to engage in activities that are incompatible with breastfeeding. Breastfeeding may decline because mothers may substitute artificial formula feeds for breastfeeding if increased economic opportunity raises the value of their time and the opportunity cost of breastfeeding. Difficulties in combining breastfeeding with working for some groups of low income or ethnic women have been noted in several studies. This is seen to show that “to many women and their families, the infant feeding choice is a matter of economics, not nutrition” (Morrow and Barraclough 1994).

However, this view is challenged by empirical studies showing that the picture is more complex, and highlighting the need for modern work arrangements to recognise the needs of breastfeeding mothers (Van Esterik and Greiner 1981). Rather than employment per se, factors such as travel time and distance to work, employment conditions, and workplace arrangements are critical determinants of breastfeeding continuation among employed mothers. Such factors are culturally and politically—not biologically—determined (Galtry 2003; Quandt 1995).

Using data reported in Popkin and colleagues (Popkin et al. 1984), a previous study by one of the authors (Smith, Ingham and Dunstone 1998) assumed that breastfeeding in Australia during the first year of the baby’s life takes 75 minutes a day on average. Artificial formula feeding was assumed to take 72 minutes a day - 40 minutes a day for acquisition, preparation and sterilisation, 25 minutes a day holding the baby to feed. Following Greiner and colleagues (Greiner, Almroth and Latham 1979), this also assumed 7 minutes a day on average for home nursing costs associated with illness in an artificially fed infant (see Cohen, Mrtek and Mrtek 1995; Jones and Matheny 1993).

- Popkin (1978) surveyed 17 bottle-feeding mothers and 33 breastfeeding mothers in the Philippines and found the former held their child for 22-29 minutes per day compared to 69-116 minutes per day by the latter. However, this took no account of preparation and sterilisation time or other indirect time costs (Popkin et al. 1984).

- Greiner and colleagues (Greiner, Almroth and Latham 1979, p. 38) report small scale surveys in the Philippines, Mexico, Kenya, and Ghana which suggested time spent breastfeeding infants aged two weeks to around 8 months varied from around 100
minutes a day to 200 minutes a day. Infants aged 1 to 23 months “breastfed” for between 33 and 91 minutes during a 12 hour observation period.

- The survey of breastfeeding mothers in Ghana by Greiner, et al. found mothers spent 40-48 minutes a day breastfeeding, with longer times (50-79 minutes) for exclusively breastfed, i.e. younger babies. By comparison, bottle-feeding mothers spent around 27 minutes per day holding the baby, but preparation and washing to minimum safe standards required an additional 135 minutes a day. Other costs were time spent nursing a sick infant, and obtaining food and fuel supplies (39 minutes daily) making a total of 211 minutes a day.

- Huffman (1980) found rural Bangladeshi women spent 2-3 hours a day breastfeeding, often simultaneously with other tasks, while Leslie (1988) found artificial feeding was three times as time intensive as breastfeeding, taking into account time for preparing artificial feeds.

The present study design addressed the above issues by:

- differentiating ‘feeding’ from ‘holding’, providing a separate activity button for each of these activities, and instructing mothers to switch activity on the device when they considered that the main purpose of their activity changed from ‘nutrition’ to ‘emotional care’ of the infant.

- data was collected throughout the 24-hour period, so that night-time activity is recorded, and feeding activity or sleeplessness is measured separately from sleep.

- data collection included variables missing in other studies including hours of paid employment related activity, time spent gaining breastfeeding skills and knowledge, infant feeding and meal preparation and cleanup time, and time spent providing or acquiring health care services for the infant.

- collecting data on help with infant care by other family members, and paid and unpaid care provided by others outside the family.

**Time tracking data collection**

Mothers were asked to track their time at 3 months, 6 months and/or 9 months post-natally. A small number also tracked pre-natally. Some tracked at just one or two of these infant ages, others completed as many as four tracking sessions over the period of the study. Overall we obtained usable data from 344 tracking sessions by 162 different mothers between April 2005 and April 2006. The mothers averaged just less than 7 days tracking each (161.2 hours for the week on average). Thus in total we collected data from 2311 diary days of tracking.

This number of diary days for mothers with infants is quite high compared to the 2926 diary days collected by the TUS for families with children under 5, which includes a much small number of infants.
Of the 188 new mothers enrolled in the study, four did not attempt a time use recording for several reasons including withdrawal because of post-natal depression, and a stillborn baby. A further 23 had unsuccessful attempts at recording due to problems operating the device.2

- Around 7 per cent of the tracking sessions were pre-natal, and the rest approximately evenly spread across the three ages (26 per cent at 3 months, 38 per cent at 6 months, and 2 per cent at 9 months).
- Around a third of the mothers participated in 3 or more tracking sessions spread over the first nine months after birth, allowing comparisons for the same mothers of how time use evolved throughout the early life of the mother-infant pair.
- Fifty five mothers tracked at least 3 sessions, at 3 months, 6 months, and 9 months.
- A small number (5) of those providing longitudinal data also tracked their time just before the baby was born.

Further details on the number of participants and tracking combinations are set out at Appendix A.

The quality of data collected using the diary method such as by the ABS TUS, is considered high, at more than 30 events daily (Craig 2004). During a typical week of tracking in the TUSNM, mothers recorded an average of 312 events, that is, 45 events daily. Excluding sleep (that is, for time recorded during awake hours) mothers changed their main activity once every 23 minutes. Further discussion of data quality is at Appendix D.

Other potentially valuable aspects of the data collected in the TUSNM include ‘case studies’ of unusual situations. For example;

- Several sets of twins enrolled in the study, and there were also a number of recordings by mothers who were tandem feeding.
- One mother was exclusively breast milk feeding her baby through expressing her milk to give in a bottle.
- One father was the full time carer of the infant, and the mother’s data was included in the study.

Further discussion of time use data collection is at Appendix E.

Preliminary findings

Survey participants

Data collected through the questionnaire shows that, compared to the Census and LSAC, the TUSNM sample had:

- Similar representation of different States, although the ACT was over represented
- Similar representation of family income categories
- Age of mothers and numbers of children broadly representative
- Higher representation of non metro areas versus cities

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2 In some cases, mothers helpfully recorded the data manually, and where possible this supplementary, manually collected data was included in the data adjustments.
• Overrepresentation of post secondary educated mothers
• Under representative of two earner couples (especially full time working mothers) and sole parents
• Over representation of breastfeeding mothers compared to National Health Survey and State surveys
• Virtually all were couples

Breastfeeding data from the LSAC shows that 52 per cent of mothers are breastfeeding at 6 months, consistent with data from the ABS National Health Survey (Donath and Amir 2000, 2002, 2005) showing breastfeeding rates at 6 months of 49 per cent, and two major recent Queensland and NSW state child health surveys showing 57 per cent and 49 per cent respectively (Gabriel et al. 2005; Hector, Webb and Lymer 2005). ³

In the TUSNM breastfeeding rates were considerably higher especially at 6 months. Around 91 per cent of mothers were giving breastmilk at 6 months.

More detailed information comparing the TUSNM sample with other similar surveys is shown in Table 3 below:

³ There are methodological and definitional differences in these surveys. For an extensive discussion of conceptual, measurement and policy issues associated with measuring infant feeding practices, see Webb (2001).
Themes and design issues

Many study participants offered comments on the study and using device, which provided valuable information for the design of future studies and gave additional insights useful for interpretation of the time tracking data.

The main themes identified in this feedback were:

- ‘Pre-emptible time’ – much of a mother’s day is ‘contingent’ on the baby or children
- The extent of multi-tasking that mothers do
- The complexity and diversity of mothers paid work and maternity leave arrangements
- How to distinguish breastfeeding, settling, sleeplessness and sleep, especially if co-sleeping
- Where and how to categorise exercise, travel, time with partner

For example, a number of mothers commented on how their day was contingent on what the baby or other children needed, and what activities they chose depended on what was compatible with care responsibilities. One mother said:
Even though I did 30 odd hours of recreation it was all at the same time I was listening out for my baby.

This ‘pre-emptible’ character of her time was also related to the need to multitask. Another commented that,

_The study has made me realise how often a mother is interrupted when trying to do something. (e.g. cook, clean). When catering for a baby's needs you are juggling tasks with attending to the baby. You really have to learn how to make effective use of small pockets of time, or to multitask._

Multitasking was difficult to record using the TimeCorder. Many mothers commented on multitasking, especially related to breastfeeding or sleeping – New mothers quickly learned to multi-task:

_I rarely do only one thing at a time. This is my third baby so my day doesn't necessarily reflect what I would like to be doing but often what my older kids need at the time like travelling to school. With the 3rd baby sometimes feeds are squeezed in wherever they can fit. So I just thought it was a particularly 'linear' view of mothering when mothering is actually multi-linear._

_Not two activities at once would have been good. For example, I often prepared infant feed and did domestic at the same time._

_A multitask recorder would be much more accurate, particularly during breastfeeding. Also I wasn't sure if breastfeeding at night should be B or M. so I put all feeding in M._

_It's often difficult to prioritise tasks. For most of my day I am doing more than one task at a time, e.g. breastfeed, and supervise 2 toddlers._

_Tricky part is remembering to change activities or deciding which to track, e.g. cooking dinner while talking to kids/supervising homework, or carrying baby in a sling at the same time._

_Could not record more than one activity at a time i.e. carry baby in sling but be doing housework at the same time._

_The major difficulty was recording sleep as I quite often fall asleep feeding or was awake but not feeding but had pressed sleeping._

_Distinguishing night-time activities and when breastfeeding ends and holding or comforting begins, was difficult for mothers:_

_We co-sleep with our baby so the feeding night measuring was often an issue as I normally don’t know when they end. The baby is in our bed and just attaches and detaches as needed. I guess then the whole night could be viewed as 'carry, hold, soothe' because this is why we co-sleep. Lastly I found it difficult to differentiate breastfeeding,_
carry, hold soothe, as for me breastfeeding is not just giving nutrient to my child it is a parenting tool.

The short amount of time mothers spend alone with their partners gave rise to the following comment on programming of the TimeCorder:

My husband even began changing my activities for me! He was wondering if you could add sex, so I would consider it a main activity in life!! I don't think so.

Regarding employment, for some mothers, employment must fit in with baby, and is likely to be home-based and highly flexible.

I work from home in whatever time I have available so it will appear fairly disjointed.

I am part of a farming partnership which makes me a taxpayer but at present only do the paperwork, phone calls, purchasing, fetching.

I am sort of back at work. Do casual hours when baby is asleep only as I can. Not in office. Return to work properly soon for 3 days a week.

Mothers participating in the study were interested in the research results and highly motivated to see where their time was used to improve their ‘performance’ in mothering. For example, one mother commented that:

Using the TimeCorder highlighted to me how much time I spend on feeding and domestic duties and how little I spend (relatively) on playing - something I plan to rectify now before this amazing opportunity slips away.

Other issues raised by the participants included how exercise and travel should be allocated.

No option given for exercise, not really about recreation, more about ‘body recovery’.

I spend lots of time driving in the car I put it under miscellaneous or added it to the activity I was travelling for e.g. social for driving to picnic etc.

Time tracking:

Figure 2 shows the approximate break-up of time for all mothers in the TUSNM. This shows that personal care (which includes sleep and sleeplessness) takes up a considerable part of a new mother’s day and conversely, employment has a very low profile. Childcare and feeding related activities dominate the awake time of new mothers.

This is even the case when childcare is counted only when ‘actively’ engaged in care of children – this definition excludes substantial time spent by mothers in ‘passive’ childcare. The amount of passive childcare increases as the baby gets older as active interaction with the baby on feeding and holding declines.
On average these new mothers spend an average of,

- 54 hours a week asleep, but are sleepless for around 5-6 hours a week;
- 14 hours a week on housework, and the same on recreation/leisure;
- 11 hours a week on feeding the baby, and 7 hours soothing and settling baby;
- Social activities and playing with kids- each 8 hours a week;
- 5-6 hours each on family meals, physical care of children, shopping, and personal care;
- Around 4 hours each on employment, supervising children, and eating/drinking alone or with partner.

**ALL MOTHERS OF INFANTS**

![Pie chart showing time allocation]

*Figure 2: Time allocation by new mothers*

Surprisingly the mothers’ workload increases slightly as infant gets older. That is, mothers do slightly less child-caring time at 9 months than at 3 months but this is more than offset by spending more time on housework, shopping, and paid work.

On average, mothers of infants are involved in (paid plus unpaid) work for a total 71-75 hours a week.

According to responses to the questionnaire, a third of mothers got no time off from the baby. The average number of hours when someone else was mainly responsible for the baby was just 7 hours a week.

**Sleep**

Some time use studies assume that sleep hours are fixed. This is clearly an invalid assumption for new mothers, as there is a wide variation in their hours of sleep. Many mothers had no sleepless nights but the range was as low as 20 hours sleep for the week and around 5 per cent of mothers had less than 40 hours sleep per week.
On average, sleep hours were reduced to around 54 hours of sleep a week for new mothers. This was spread over around 60 hours of sleeping and napping interspersed with sleeplessness.

By comparison European adults typically sleep between 53 and 63 hours a week (European Communities 2003), with average sleep hours for those older than 8 years of age being around 59 hours in the UK. Pregnant women in this survey slept on average 62 hours a week at the high end of the range of these European studies. The average for mothers with babies 3-9 months (54 hours a week) are at the low end of the range. This reduced sleep wasn’t explained by more hours of sleeplessness, which went up by only one hour.

Fewer hours of sleep were associated with the increased hours of unpaid work after the baby was born. Mothers in paid employment did not seem to sleep less than those who were working entirely unpaid. It was the high unpaid workload that determined how much sleep a new mother got. Paid work hours show little correlations with the amount of sleep, perhaps reflecting that paid work hours were relatively small in this sample.

This is consistent with the European finding for those with more of their time predetermined (assumed in that study to be those employed), who have less sleep and less free time (European Communities 2003). That is, new mothers’ sleep and time use patterns more closely mirror those of the employed, rather than those of the unemployed or retired.

Figure 3: Correlation between sleep hours of mother and sleeplessness
Reduced work hours by the mother’s partner seemed to help the mother get more sleep, presumably because of the greater assistance he could give with other children and with the housework. The correlation between a mother’s hours of sleep was greater for partner’s hours of work than it was for whether they or their baby woke a lot at night (Figure 4).

‘Leisure time’, ‘time off’ and help with the baby from partner

Compared to the pregnant mothers in the sample, first time mothers
- Halve their recreational/leisure time – to around 16 hours a week
- Lose more than 13 hours a week for personal care including sleep
- Lose 10 hours of social interaction
- Work 10 hours less of paid work a week,
- Do around 3-4 extra hours of housework/shopping
- Provide 44 hours a week more childcare

‘Childcare’ is mainly;
- infant feeding and settling/soothing (29 hours),
- physical care (6 hours), and
- playing (5 hours)

According to questionnaire responses, mothers had an average of around 7-8 hours a week when they did not have the main responsibility for care of the infant or other children. That is, the time spent by mothers in ‘passive childcare’ is around 160 hours a week. This is four times greater than active childcare of around 44 hours a week, confirming the size and economic significance of ‘passive’ childcare (Ironmonger 2001 [2004]).

It is the latter that is typically measured by most time use surveys, whereas it is the former that determines how the mother structures her activities and time use (Folbre et al. 2005). Mostly, mothers had no time off from the baby and children (around one third of mothers).
For mothers of newborns, the median time without any childcare responsibilities was 1 hour a week. For those with older infants it was around 2-3 hours, increasing with the age of the baby.

The study did not track how much time that partners’ spent on unpaid work, but the questionnaire did ask mothers about how many hours their partner cared for the baby. Mothers got slightly more help with the first baby, and with older babies (averaging 6 hours and 5 hours a week by 6-9 months, median 3 vs. 2 hours). A small number of mothers reported their partner shared equally in caring for the baby. Mothers reported that the average time their partner cared for the baby was about 4-5 hours a week. However, the median number of hours a week that partners were caring for the baby was around 2-3 hours, reflecting the skew in the data from a small number of fathers who cared full time for the infant.

It should be noted that these figures do not include the time that partners spent doing housework, or caring for children other than the baby.

**Duration of activities**

Table 3 shows the typical duration for each event, based on the time stamp data. The table is arranged from the shortest event (preparing formula) to the longest event (sleeping).

On average mothers changed what they were doing every 32 minutes - or every 23 minutes excluding sleep (i.e. time recorded during waking hours).

Notably mothers’ sleep hours were obtained in 18 different episodes in the tracking week, with each stretch of sleep averaging just over 3 hours (188 minutes). Likewise, mothers were kept awake on average 6 nights a week, for around three quarters of an hour on each occasion.

Infant care activities also tend to be more frequent, and of shorter duration than other activities, with a total of 70 occasions a week when mothers were feeding or carrying/holding/soothing their infants, for around 13-18 minutes each time.

By comparison, adult activities such as social or employment tended to be longer, but much less frequent. For example, the longest episodes of activity (apart from sleep durations averaging just over 3 hours at a time) were for employment, with an average of 3 episodes lasting an hour and twenty minutes. This is more likely than other activities to be undertaken without the infant or other children present, and perhaps therefore less 'pre-emptible' by the needs of children.

Similarly, socialising or shopping was less frequent but was undertaken in episodes of approximately an hour long. Such activities may be conducted alongside the care of infants, but such childcare may not necessarily interrupt the main activity.
Table 3: Duration of each episode of activity

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DURATION</th>
<th>OCCASIONS PER WEEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare infant formula</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Bath, dress, change, teeth</td>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>Travel to feed baby</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Carry, hold, soothe infant</td>
<td>13</td>
<td>35</td>
</tr>
<tr>
<td>Other personal care</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Feed formula from bottle</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Meals with kids alone</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Nurse, sooth, medicate unwell infant</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Teaching eating</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Breastfeeding or give expressed milk</td>
<td>18</td>
<td>35</td>
</tr>
<tr>
<td>Eating, drinking alone</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>Play, read, talk to children or teach</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Domestic</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>Education re breastfeeding, formula prep</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Minding</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Meals with kids, adults present</td>
<td>27</td>
<td>14</td>
</tr>
<tr>
<td>Child care</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>33</td>
<td>4</td>
</tr>
<tr>
<td>Recreation, television, leisure</td>
<td>38</td>
<td>21</td>
</tr>
<tr>
<td>Purchasing medical services, products</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Other education</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>Sleeplessness</td>
<td>43</td>
<td>6</td>
</tr>
<tr>
<td>Volunteering</td>
<td>46</td>
<td>2</td>
</tr>
<tr>
<td>Social</td>
<td>55</td>
<td>9</td>
</tr>
<tr>
<td>Purchasing</td>
<td>64</td>
<td>4</td>
</tr>
<tr>
<td>Employment</td>
<td>82</td>
<td>3</td>
</tr>
<tr>
<td>Sleeping and napping</td>
<td>188</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>312</td>
</tr>
</tbody>
</table>

Infant feeding data from the TUSNM

The TUSNM shows that infant feeding and emotional care dominates mothers’ time in the first several months of an infant’s life.

This study measured ‘feeding’ separately from ‘emotional care’ activities, distinguishing as far as practicable the nutritional element of feeding from where the main purpose of feeding
was comfort rather than nutrition, such as when a baby is feeding to sleep or dozing on the breast after a feed. Such ‘carry, hold, soothe’ activity can be categorized as ‘emotional care’ in the ABS terminology.

Substantial time spent by mothers in this activity reflects ‘interactive’ mothering styles or behaviours which are identified by medical, epidemiological and psychological researchers as one of two causal pathways influencing normal brain growth and cognitive development in human infants (Burgard 2003; Feldman and Eidelman 2003).

Infant sleep, crying and maternal behaviour patterns (Lee 2000; St James-Roberts et al. 2001; Thomas 2000), and longer term psychosocial and cognitive development (Fergusson and Woodward 1999) are closely related to infant feeding practices, although in ways which are still poorly understood (Burgard 2003).

Breastfed infants have been found to sleep less, cry more, and so are fed more often by their mothers than formula fed infants (Lee 2000; Thomas 2000).

As can be seen in Figure 5, the time spent breastfeeding reduced dramatically over the first nine months of the infant’s life, after occupying around 16 hours a week at 3 months.

By 9 months, the average time that mothers spent breastfeeding had more than halved. This was mainly because of less frequent feedings. At 3 months, the babies fed on average 49 times a week, while this had reduced to 28 hours a week at 9 months. Feeds were only slightly quicker by 9 months.

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4 The other is through the various components of human milk (for example, long chain polyunsaturated fatty acids (LCPUFAs), oligosaccharides, thyroid stimulating hormone, nerve growth factor) which influence development via the nervous system.
Figure 6 below provides an example of the use of the time-stamp data which was collected in this study, showing the pattern of feedings throughout the day.

![Breastfeed or give expressed milk](image)

**Figure 6: Daily feeding events, occasions**

It can be seen that a substantial number of the survey infants are feeding at night, and late in the evening, and that there are peaks of feeding activity first thing in the morning, and late in the afternoon.

![Breastfeed or give expressed milk - Duration](image)

**Figure 7: Daily feeding events, duration**
Likewise Figure 7 shows the duration of feeds at different times of the day. The data in Figure 7 suggests that babies feed for longer during the night than they do during the day.

This could reflect a more abundant flow of milk at certain times of day, or it could reflect that mothers are more likely to shorten feedings to accommodate other demands on their time during the day than during the night or evening. It may also reflect less precise recording of activities during ‘sleep’ time.

In Figure 8 below, we see comparable data for the ‘emotional care’ activities of new mothers. It can be seen that this ‘carry, hold, soothe’ activity also accounts for a significant amount of mothers’ time.

Furthermore, the patterns as the baby gets older are similar to the patterns for breastfeeding – reduced time sent in emotional care of the infants due to fewer interactions, rather than significantly shorter interactions.

![Figure 8: ‘Carry, hold, soothe’, by age of infant](image)

Figures 9-10 below show the patterns for emotional care by time of day. Again, these closely mirror the pattern for breastfeeding, with more frequent episodes during waking hours, but longer episodes at night.

Likewise, Figures 11-12 show the correlation between time spent on total feeding activity and ‘emotional care’. In Figure 11, breastfeeding activity is shown compared to ‘soothe, hold, carry’ time.
The correlation is considerably higher between breastfeeding and ‘soothe, hold, carry’ time than is the case for total feeding related activity (Figure 12). Total feeding related activity includes time spent on breastfeeding, preparing formula feeds, bottle feeding, preparing and feeding solid foods.

This is likely to be because such feeding activities other than breastfeeding require considerably less ‘carry, hold, soothe’ interactions with the infant.

*Figure 9: Daily carry, hold, soothe events, occasions*

*Figure 10: Daily carry, hold, soothe events, duration*
Figure 11: Correlation between hours spent on ‘emotional care’ activity and breastfeeding

Figure 12: Correlation between hours spent on ‘emotional care’ and feeding-related activity
SUMMARY AND CONCLUSIONS

The Australian TUSNM provides a unique data set on the time use of new mothers, including in providing both cross sectional and longitudinal data for the first 9 months with a new baby, and in surveying a group which is poorly represented in the population-based TUS samples.

This study has used an innovative approach to tracking time use among new mothers, which highlights the methodological and conceptual challenges in understanding time use among mothers, and provides the basis for informing research in a number of disciplines investigating aspects of women’s unpaid work and maternal care of infants and children.

The use of technology is shown to have considerable potential for time use research. Data quality in terms of daily events recorded was very high. The time stamp data collection is also unique, providing a basis for understanding the usual feed and sleep patterns of infants, and the influence this has on mothers’ time use allocation.

This analysis, whilst preliminary only, has illustrated the particular time stresses on mothers of infants, and the age of peak demands from the infant. These time pressures are associated mainly with infant-driven feeding and emotional care activities. However, time pressures increase as the infant gets older and mother increases her hours of paid work, housework and shopping.

The impact of infant care on a mother’s time use is most evident in the finding that new mothers are in effect ‘on call’ 23 hours a day. This commitment of time to being available to meet an infant’s needs is more than four times as large as the ‘active’ childcare commitment that is commonly measured by official time use surveys.

While this study did not measure fathers’ unpaid work directly, the data is suggestive that new fathers who reduce their hours of paid work do contribute indirectly to maternal health and well being through allowing her more time to rest or sleep.

The time intensity of demands on new mothers has important implications for health, labour market and family policies. Replacing maternal care of infants with comparable quality market-based childcare services is likely to be particularly costly in order to match the very time-intensive maternal input into interactive infant care. This highlights the role of maternity leave as an alternative policy to childcare for providing cost-effective quality infant care, as well as improving gender equity.

If the Magic Pudding of mothers’ care work is not to run dry integrated policies regarding families and work must balance the economic value and social return from mothers’ reproductive work in the ‘care’ economy, against the economic value and individual financial returns to prioritising time in the market economy.

Studying the time use of new mothers reveals the tradeoffs in the front line of this conflict.

With clear scientific evidence on the health risks of not breastfeeding, governments and medical authorities in many countries - developed as well as developing – now advocate and promote breastfeeding.
However, the substantial time costs to mothers of breastfeeding are rarely acknowledged or supported. Time is an important element of the cost of production of breastmilk as maternal time has a significant economic as well as personal “opportunity cost”. Mothers’ time feeding a baby is part of the resource cost of an infant feeding method. It can also be viewed as an investment by the mother in human capital as a range of studies show later life cognitive and other health differences associated with lack of breastfeeding in infancy.

In this study, breastfeeding appears to be associated with large investments of time by mothers in ‘interactive’ care. This has significant research and policy implications. A number of studies find links between lack of breastfeeding in infancy and poorer cognitive development and IQ levels in later life. However, it is unclear whether this reflects residual confounding due to beneficial effects of a ‘nurturing’ mothering style (Burgard 2003; Feldman and Eidelman 2003). If nurturing behaviours are confirmed to be highly correlated with breastfeeding, as seems to be the case in this study, then mothering style or behaviour may be considered to be part of the causal pathway by which infant feeding practices affect cognitive development, rather being viewed as a confounding factor.

The relative time costs of breastfeeding also matter for policy. Time use data on infant feeding from developing countries has showed that artificial infant feeding has high time costs for mothers in such environments, because of the lack of suitable facilities and infrastructure to ensure clean preparation of feeds. In developing country studies, this higher preparation cost more than offsets the lower time costs involved in actually feeding/holding the baby.

However, results from the TUSNM suggest that this may be less likely to apply in modern living environments. This finding suggests that a significant underlying economic force undermining breastfeeding during industrialisation and over time has been improved sanitation, clean water supply, better housing, and easier access to shopping facilities, uncontaminated supplies of cows or goat’s milk, and commercial baby food products. These public infrastructure and food market factors may significantly reduce the time costs of artificial infant feeding. While better labour market opportunities for women may increase the economic opportunity cost to mothers of breastfeeding, the findings of this study on regarding the time costs of breastfeeding suggest that the much lower time costs associated with artificial feeding could be an even greater influence in reducing breastfeeding.

From a policy viewpoint, it is therefore important to recognise that the relative time costs to mothers of artificial feeding including preparation and clear up are apparently reversed in modern, developed country environments. This provides an economic disincentive for individual mothers to breastfeed, even if insufficient breastfeeding results in significant ‘external’ economic costs to the infant and the wider community (Cattaneo et al. 2006; Smith, Thompson and Ellwood 2002). The discrepancy between the individual and social costs and benefits of investing time in breastfeeding represents a market failure (Smith 2004), which has important implications for future population health as well as child health and development.

Time is also important to understanding which mothers cannot afford to breastfeed. In Australia, it is mainly well educated middle class mothers who breastfeed. Those with more time and money resources can afford to reduce their labour force participation and invest time in infant care. However, mothers in less advantaged households may be pressed for both money and time, possibly with less support from partners who may themselves have to work longer hours to earn a living. For such mothers the extra time they gain for leisure and for
employment by formula feeding may more than compensate for the additional financial costs of commercial baby foods and feeding related products. This may be reinforced if the time costs of infant feeding and care can be more easily shared with others through bottle feeding. Such questions will be explored in more detail in the future using data from the TUSNM.

However, research so far points to the importance of adequate paid maternity leave and the need to develop adequate support systems, such as home help or paid paternity leave, to ease the new mothers’ shortage of time resources, especially for economically or socially disadvantaged mothers.

It also suggests a need for work conditions and work arrangements which accommodate the needs of new mothers to prioritise infant care, including breastfeeding breaks and flexible, reduced hours.
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Webb, K., Marks, G., Lund-Adams, M., Rutishauser, I., and Abraham, B. 2001. *Towards a national system for monitoring breastfeeding in Australia: recommendations for population indicators, definitions and next steps*, National Food and Nutrition Monitoring and Surveillance Project, Commonwealth Department of Health and Aged Care, Canberra,

World Health Assembly (Fifty Fourth) 2001. Infant and Young Child Nutrition: Resolution 54.2., Geneva.
APPENDIX A: PARTICIPATION

The following table shows how many weeks each participant conducted the study. Altogether, 162 different mothers tracked their time, generating 344 sets of data. Some only tracked their time for one week, some for two weeks, some for three and some for four.

The table below shows the various combinations of weeks that participants tracked. The most common were the CD combination (3-6 months followed by 6-9 months) and the BCD combination (three sets of data after the baby was born.)

A total of 55 mothers tracked at 3, 6 and 9 months, with five of these also doing a tracking session before the baby was born.

<table>
<thead>
<tr>
<th>Weeks tracked</th>
<th>Number of mothers</th>
<th>Total data sets collected for this combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABCD</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>ABC</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>BCD</td>
<td>41</td>
<td>123</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>BC</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>CD</td>
<td>47</td>
<td>94</td>
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<td>AC</td>
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<td>4</td>
</tr>
<tr>
<td>BD</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>D</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>161</td>
<td>344</td>
</tr>
</tbody>
</table>
APPENDIX B: TIMECORDER PROFESSIONAL TIME TRACKING SYSTEM

Mothers tracked their time using a TimeCorder professional time tracking system, a portable, hand-held device about 4 inches wide by 7 inches long. This electronic device allows time study participants to easily track their time by pushing keys associated with pre-coded activities.

The device has a keyboard with letters labelled A to Z. Each key is associated with an activity and a timer. Each time a participant presses a key, a stopwatch is activated. Time begins accumulating on a new activity and stops on the previous activity. In addition to cumulative time, the TimeCorder also tracks the number of occasions for each activity. When a key is pressed, the “count” for that activity increases by one.

The accumulation of these counts is referred to as occasions. By dividing cumulative time by the number of occasions, a typical duration is derived. It is the average length of time for which an activity occurs, expressed in minutes. Also, each time a button is pressed a time stamp is created. This shows exactly when an activity occurred. It shows patterns of activity throughout the 24-hour day.

This method of data collection is superior to other methods of collecting time use data because it involves a series of real-time stopwatches, rather than relying on memory. Data recorded with the TimeCorder is tracked accurately to the second. The results are expressed in tenths of hours for the time, and in minutes for the duration. Some of the numbers may not always appear to add or divide evenly because of rounding (i.e. 2.1 hours as reported is actually 2.13 hours).
APPENDIX C: TIME OF DAY (“TIME STAMP”) DATA

Each time a button on a TimeCorder is pressed, time accumulates on a main file. In addition, a timestamp is created, indicating the actual date and time. Times are set on the device at the host computer. When devices came back from the field, adjustments to the date stamps were made to accommodate local time zones. Thus, all of the timestamps are synchronized, as if all of the participants lived in one master time zone.

The timestamps were imported into a custom-designed Excel spreadsheet program by weeks; A, B, C, and D. All of the participants who participated in each week are included. The exceptions are when time stamp data was not available. This version of the TimeCorder device (which has since been updated) occasionally erased the time stamps when batteries ran low. Main data was not erased.

Of the 344 data sets that make up the database, 310 have usable time stamps. Four batches of data sets were brought in together; all of Week A (21 sets), all of Week B (77 sets), all of Week C (117 sets) and All of Week D. (95 sets).

Once the data was imported, adjustments needed to be made to eliminate those timestamps associated with long activities. Manual adjustments to recorded activities that participants made do not affect the timestamps. So, if the participant accidentally left the device on an activity all day, she was able to manually take time out of one activity and add it to another. However, the timestamps are unaffected by this, because there would be no way for user to indicate what time of the day she wanted adjusted.

Consequently, many long activities in the time stamp data were cleaned. Anything above 15 hours (except for sleep) was deleted. For activities between roughly 5 and 15 hours, those activities that were obviously too long in relation to other activities were usually removed. Usually, this involved no more than one event per activity name, so the number of adjustments was relatively small. For example, within the minding activity in Week B, one time stamp out of 611 was removed, leaving a very large sample of time stamps for the ‘minding’ activity.
APPENDIX D: DATA QUALITY

The data gathered has a high degree of quality. During a typical week of tracking, the average mother recorded 312 different events. She changed from one activity to another every 32 minutes. This includes long periods of sleep. Excluding sleep, (i.e. time recorded during waking hours) mothers typically change activities every 23 minutes. For comparison, employees who conduct Pace Productivity’s time studies with the TimeCorder device during working hours change activities every 15 minutes.

The tracking is also very consistent across the tracking periods. Many participants tracked more than one session. Overall, there were no unexplainable declines in frequency of recording from one period to the next.

<table>
<thead>
<tr>
<th></th>
<th>Total occasions per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-natal</td>
<td>172</td>
</tr>
<tr>
<td>0-3 months</td>
<td>331</td>
</tr>
<tr>
<td>3-6 months</td>
<td>337</td>
</tr>
<tr>
<td>6-9 months</td>
<td>294</td>
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The reason for the measured decline in occasions from the third to the fourth tracking session is mostly attributable to the very substantial decline in breastfeeding events and carry, hold, soothe events.
APPENDIX E: DATA COLLECTED

As of June 26, 2006, the time tracking database consists of 344 data sets of 27 records each. Altogether, 55,468.1 hours have been tracked. 102,493 individual events have been tracked in real time. Data is available from 162 participants, many of whom tracked their time more than once (see Appendix A). The maximum number of weeks / sessions that they could have tracked is four, related to different stages of their infant’s life: pre-natal, 0-3 months, 3-6 months, and 6-9 months.

Other time use researchers, who typically use two-day diary studies to gather data, have wrestled with how to account for changes from weekdays to weekends. Often these results are shown separately, or adjusted. However, for this research, most respondents gathered their time for a full week. The target was for each mother to track 168 hours; that is 7 days X 24 hours. This would be a considerable improvement over 2-day studies where weekends are almost always over represented or under represented. A week includes a good cross section of activities, yet is not too long that fatigue would set in.

There was no set day of the week for participants to begin tracking their time. Hence, if there was any fatigue, it would have evened out with different participants starting at different times of the week. Based on an analysis of time stamps, fatigue does not appear to be a factor. Participants were as diligent in collecting data at the end of their one-week period as at the beginning. (See Appendix D on data quality)

Although participants were asked to track their time for a week, they could not be expected to track exactly 168 hours to the second. Therefore each individual’s data has been pro-rated to show a full week. Some were adjusted higher, some lower.

On average, respondents tracked 161.2 hours. The reason for the shorter-than-ideal duration is that a) some respondents’ TimeCorder devices ran out of battery power, resulting in a truncated study for them. The battery system was designed to last the entire study, but sometimes shipping time drained the batteries before the study began. Also, some participants may have stopped tracking for their own reasons.

Adjusting to a standard 168-hour week for those who tracked for a shorter period does not distort the data significantly, because of the large sample of events. The percentage of time by activity is the same on the raw data as in the cumulative adjusted data. For instance, sleep time might be expected to change the most because of adjustment. This is because it usually occurs at the same time every day, and is a large percentage of the day. Those who finished the study early in the evening, for whatever reason, might have missed sleep occasions. In fact, as the data is evened out, this is not the case; sleep, as a percentage of total time as shown on the adjusted data is 32.7976% of the time. Sleep time as a percentage of the raw data is 32.7901%.

Among the 344 data sets, a small number of mothers tracked more than a week. 73% of the data sets were for 168 hours or more. As shown below, most participants tracked 7-8 days. The distribution of the number of days tracked is as follows:
### # of days tracked | # of data sets | % of data sets
---|---|---
1-2 | 3 | 1%
2-3 | 5 | 1%
3-4 | 7 | 2%
4-5 | 16 | 5%
5-6 | 18 | 5%
6-7 | 44 | 13%
7-8 | 234 | 68%
8-9 | 16 | 5%
9-10 | 0 | 0%
10-11 | 0 | 0%
11-12 | 0 | 0%
12-13 | 1 | 0%
TOTAL | 344 | 100%

A unique feature of the TimeCorder is its ability to make manual adjustments. Occasionally, participants may have inadvertently left the device running on one activity while they had actually changed to another. In those cases, they were given instructions in advance on how to make manual adjustments. Typically, adjustments were for 10-90 minutes.

However, some participants mistakenly made adjustments of 15 hours rather than 15 minutes. In those cases, the data was re-adjusted by researchers where the adjustments were obviously incorrect. In many cases we were able to ascertain this by matching up the main data with parallel data created by the timestamps. The timestamps are unaffected by manual adjustments and can be used to reconcile the main data.

So, for instance, where manual adjustments made by the participant resulted in a total study length of 250 hours, and the time stamp data indicated that the maximum time would be just 180 hours, 70 hours could be confidently subtracted from an activity that was highly inconsistent with results from other participants.

In some cases, numerous overstated adjustments had been made and it was unclear by deduction what the true picture should have been. These data sets were discarded.
Some data sets were also discarded because the time recorded was too small and could distort the data. For instance, if a participant recorded just 16 hours of data, within which 8 hours was sleep, her total time when adjusted to a full week would show sleep at 50% of her time, an unrealistic amount. Data sets from less than 15 hours recording were discarded.

Where significant, the time allocated to the miscellaneous category was reallocated according to any information added to the questionnaire by the participant.

Altogether, 344 time tracking data sets out of a possible 369 sets that were received from participants were used, 25 were not, representing a completion rate of 93%. Another 19 sets, bringing the total to 388 were of insufficient length or quality and were discarded. For comparison, Pace Productivity’s corporate participation, where employees are required to complete these studies and are not volunteers, is about 96%.

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<table>
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<tr>
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<tr>
<td>25</td>
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<tr>
<td>19</td>
<td>Data not received back from participants</td>
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<td>388</td>
<td>Total participant sessions</td>
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