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Abstract

Background: The benefits of exclusive breastfeeding, including public health cost savings, are widely recognized, but breastfeeding requires maternal time investments.

Objective: This study investigates the time taken to exclusively breastfeed at 6 months compared with not exclusively breastfeeding.

Methods: Time use data were examined from an Australian survey of new mothers conducted during 2005–2006. Data from 139 mothers with infants age 6 months were analyzed using chi-square tests of independence to examine socioeconomic and demographic characteristics and 2-sided *t* tests to compare average weekly hours spent on milk feeding, feeding solids, preparing feeds, and the total of these. The comparison was of exclusively breastfeeding mothers with other mothers. We also compared exclusively breastfeeding with partially breastfeeding and formula feeding mothers using a 1-way between-groups analysis of variance (ANOVA).

Results: The exclusively breastfeeding (vs other) mothers spent 7 hours extra weekly on milk feeding their infants but 2 hours less feeding solids. These differences were statistically significant. ANOVA revealed significant differences between exclusively breastfeeding mothers, breastfeeding mothers who had introduced solids, and mothers who fed any formula, in time spent feeding milk, and solids, and preparing feeds.

Conclusion: Exclusive breastfeeding is time intensive, which is economically costly to women. This may contribute to premature weaning for women who are time-stressed, lack household help from family, or cannot afford paid help. Gaining public health benefits of exclusive breastfeeding requires strategies to share maternal lactation costs more widely, such as additional help with housework or caring for children, enhanced leave, and workplace lactation breaks and suitable child care.

Keywords

breastfeeding, breastfeeding/economics, costs and cost analysis, evolution, gender equity, maternal employment, time factors

Well Established

Resource-poor mothers wean sooner from exclusive breastfeeding. Despite its health benefits, lactation has economic costs for mothers, requiring time and energy. Evidence is very limited on whether mothers save time by starting solids or formula prematurely if facing time resource pressures.

Newly Expressed

Exclusive breastfeeding at around 6 months takes more time than mixed feeding. To gain the public health benefits of exclusive breastfeeding, community and family measures to limit maternal work burdens and time pressures are necessary.

Background

There is wide acknowledgment of the importance of breastfeeding for protecting infant and child health,^{1–3} reducing

disease and mortality,⁴ and containing health system costs.^{5–8} Studies in Australia, the United States, and Europe have illustrated the large magnitude of short- and long-term health system costs associated with premature weaning from breastfeeding.^{5,7–10} Health authorities recommend 6

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months of exclusive breastfeeding, with sustained breastfeeding into toddlerhood.^{11,12} In Australia, health ministers recently endorsed a national strategy to increase breastfeeding,¹³ though funding for new policy measures has not yet been committed.

It is rarely acknowledged that exclusive breastfeeding for 6 months may have high economic time costs for women, although such costs have important implications for the effectiveness of health policies and programs promoting breastfeeding.^{14,15} Some studies in developing countries explore the issue conceptually and empirically,¹⁶⁻¹⁸ but the maternal time cost implications of exclusive breastfeeding at 6 months have not been investigated in a developed country setting.¹⁹

The intense demands on a new mother create time stresses that may severely affect maternal ability to participate in unpaid or market employment in the months after the birth of an infant. Mothers overburdened with infant and child care and imperatives to generate household income through informal sector or market work may respond to time or material resource constraints by reducing breastfeeding despite its health and nutrition benefits.

Both economic and evolutionary theories point to the likelihood of tradeoffs in how long and how exclusively infants are breastfed.^{20,21} Such time tradeoffs, and the distribution of these costs and benefits of breastfeeding between self and others, influence women's ongoing decision making on maintaining exclusive or any breastfeeding as their child gets older.²²

Early weaning from breastfeeding has been identified in anthropological and ethnographic research as an adaptive maternal response to resource constraints, with early introduction of formula or solid foods argued to ameliorate tradeoffs between maternal costs of lactation and risks of poor infant outcomes.^{15,23,24} As well as reducing physiological demands of lactation on the mother, feeding formula may reduce maternal time costs due to reduced frequency of feeds. Adding other foods to the infant's diet also facilitates sharing infant care with others. Among human populations, maternal investments are most crucial for infant survival and health, but "allo-parent" and wider community investments of resources in infants are also important to successful breastfeeding and reproduction of the species.^{21,25,26}

Workforce participation by women has been rising in recent decades, with around 40% of new mothers in Australia now in paid work by 12 months, and 21% at 6 months (mostly working part-time hours).²⁷ A recent time use study showed that the sharing of unpaid work burdens in dual earner couples has changed little over time for families with young children.²⁸ Australia has relatively low full-time maternal participation rates.²⁹ Only 10% of Australian mothers of infants age 6 months spend substantial hours (> 20) in employment: 80% were not in employment and the other 10% worked fewer than 19 hours per week.²⁷

Reduced maternal labor force participation and earnings not only affects women's current income. Depending on how retirement pensions are funded, maternity leave may also be

at the expense of maternal income and economic well-being throughout the life cycle, and particularly so in countries where social security entitlement rests on prior paid labor force participation and employee contributions to social insurance.^{30,31}

A number of studies have found lower breastfeeding rates or duration among employed mothers in a variety of developed country settings.³²⁻⁴⁵ Australian research finds lower breastfeeding rates among new mothers who are employed full time.⁴⁴ Though breastfeeding initiation has increased considerably since the 1980s, including through measures such as the Baby-Friendly Hospital Initiative (BFHI),⁴⁶ breastfeeding duration and exclusivity at 6 months have not been addressed.⁴⁷ In Australia, breastfeeding rates have recently been examined in the Infant Feeding Survey.⁴⁸ This showed that around 60% of infants were breastfeeding at 6 completed months but only 2% of infants were exclusively breastfed for 6 full months. Among employed Australian mothers, only around 52% breastfed for the full 6 months. Similar patterns of short breastfeeding duration and low exclusivity are evident in many other countries.⁴⁹

The dilemma facing time-pressed mothers in modern societies appears to have been recognized by both the Australian Parliamentary Inquiry into Breastfeeding⁵⁰ and the recent Productivity Commission inquiry into paid parental leave.⁵¹ The latter acknowledged potential benefits to mother and child health and well-being from parental leave, which gave mothers and babies more opportunity to breastfeed for longer.

Understanding these maternal trade-offs has been important to formulating public policy in these areas of public health and employment. However, there is a lack of research on time spent on infant feeding and care as time use data on mother-infant dyads are rare.^{15,52} Population-based stratified sample surveys of time use, such as the recently discontinued Australian Bureau of Statistics Time Use Survey (ABS TUS), do not identify activities of specific relevance to mothers with infants, such as feeding, because these surveys are primarily designed to measure broad categories of activities engaged in by most of the adult population. The Child Development Supplement of the Panel Study of Income Dynamics in the United States and the American Time Use Survey have large time use datasets for infants but also do not collect on infant feeding method, even where time spent on breastfeeding is measured as an activity (see, for example, Ramey).⁵³ Notwithstanding some small time use studies in developing country settings,¹⁵ there are no published studies on the relative maternal time costs of exclusive breastfeeding, although there are studies on maternal time costs of expressing milk for premature infants in the unusual setting of neonatal intensive care units in the United States.⁵⁴ There are time use data for infants, but not mothers, in the Australian Longitudinal Study of Australian Children (LSAC).⁵⁵

This study therefore addresses the question of the time cost of exclusive breastfeeding using a unique and purpose designed dataset combining detailed information on

maternal time use with information on infant feeding-related variables. Specifically, this study asks how long it takes mothers to exclusively breastfeed at 6 months, and whether this is significantly longer than mixed feeding after accounting for food preparation time. Because feeding formula may extend the time between feeds more than feeding solids, we also investigate whether mothers of infants receiving any formula spend less time on feeding activities than those feeding their infants no formula.

Methods

Time use data were examined from the Time Use Survey of New Mothers (TUSNM), conducted in Australia over 12 months from April 2005. All participants gave written informed consent before enrollment in accord with the study protocol approved on March 10, 2005 (Protocol 2005/51), by the ANU Human Research Ethics Committee under the *National Statement on Ethical Conduct in Research Involving Humans*.⁵⁶

Participants were recruited through national playgroup and breastfeeding support organizations and through maternal and child health professional networks, infant health clinics, and child care centers.

Time use data were collected through electronic tracking, using TimeCorder time tracking devices (see note 1). These were posted to the mothers within 2 weeks (before or after) of the infant reaching 6 months of age. Data on the frequency, duration, and time of day of each activity were recorded for 24 hours a day, 7 days a week, through participants pressing appropriately coded buttons on the device corresponding to their current activity.

Main categories of activities tracked were those used in the official ABS TUS but modified to include detailed child care activity categories pertaining to infant care: for example, “breastfeeding or giving expressed milk,” “preparing feeds,” and “teaching to eat” (feeding solids), activities that would be included under “Childcare: Physical” in the ABS TUS. Further detail on the TUSNM is available elsewhere.¹⁹

Socio-demographic data including maternal age, education, and employment status and number of other children were collected via an accompanying written questionnaire filled out by the mothers during the 7-day period of time tracking. This questionnaire also collected data on infant feeding methods for that 7-day period.

Feeding method was self-categorized by mothers. The mothers reported whether feeding over the past 7 days was (1) breast milk only; (2) formula milk only; (3) breast milk and formula milk—no solids; (4) breast milk only and solids, or other drinks; (5) formula milk only and solids, or other drinks; or (6) breast milk and formula and solids, or other drinks. Self-reporting of feeding method was then verified by cross-checking against time use data on feeding activities. Exclusively breastfeeding (EBF) mothers are defined as those giving no food or drink other than breast milk (category 1). Mothers who are feeding breast milk and solids (4)

are described as partially breastfeeding (PBF), while mothers in 2, 3, 5, or 6 are categorized as any formula feeding (FF).

We analyzed data for 139 mothers who had infants age 6 months to compare the mean weekly hours spent on milk feeding, feeding solids, and preparing feeds (formula, solid foods, or expressing milk).

Power calculations were not made due to the lack of previous studies indicating likely effect size for feeding method on the amount of feeding time. Significance was set at .05.

Statistical analysis used chi-square tests of independence to identify any differences in feeding groups’ socioeconomic and demographic characteristics, and 2-sided *t* tests and a 1-way between-groups analysis of variance (ANOVA) to compare average weekly hours spent on milk feeding, feeding solids, preparing feeds, and the total of these feeding activities. Analysis used PASW 18.0.1 software.

The comparison groups for chi-square and *t* tests were exclusively breastfeeding mothers versus other feeding groups (PBF and FF). As preliminary assessment showed some skew and extreme values in time use variables, significance testing of continuous variables was conducted using log transformed data (the numeral 1 was added to the data prior to transformation to avoid the problem of log zero).

As it was expected that mothers who were feeding any formula would spend less time feeding than the mothers whose infants did not have formula, an ANOVA was conducted to explore the separate impact on maternal time use of adding solids and of adding formula to infants’ feeding regimes, compared to exclusively breastfeeding. This analysis was conducted on data where participants had been divided into 3 mutually exclusive groups according to whether they were exclusively breastfeeding (EBF), breastfeeding and solids or other drinks only (PBF), or giving any formula as part of the infant’s diet (FF). As preliminary analysis of milk and solid feeding showed violation of the homogeneity of variance assumption for ANOVA, data were log transformed prior to analysis.

Results

Key socio-demographic and infant feeding characteristics of the sample are shown in Table 1. All mothers lived in couple families. Of the 139 infants age 6 months at the time of the survey, 16 were exclusively breastfed and 123 were partially weaned (receiving formula or solids).

Table 1 shows the main socio-demographic characteristics of the participants by whether or not they were exclusively breastfeeding. Differences between the feeding groups in socio-demographic variables were not statistically significant except for the number of children ($P = .01$). Exclusively breastfeeding mothers had significantly more children, compared to those who were not exclusively breastfeeding.

Table 2 compares the mothers’ weekly hours spent milk feeding, solid feeding, and preparing foods for the 2 feeding groups. Exclusively breastfeeding mothers spent approximately 18 hours per week on average breastfeeding their

Table 1. Sample Characteristics by Feeding Group of Infants Age 6 Months^a

	EBF (Total n = 16)	PBF or FF (Total n = 123)	P Value
State			
Australian Capital Territory	2	23	
New South Wales	5	30	
Queensland	2	20	
South Australia	2	8	.886
Tasmania	0	6	
Victoria	4	26	
Western Australia	1	10	
Residence			
Urban	12	98	.665
Rural	4	25	
Maternal education			
Secondary	0	10	.236
Postsecondary	16	113	
Family income ^b			
High	9	66	.573
Low	5	51	
Number of children			
1	4	60	.01
2	5	46	
> 2	7	17	

Abbreviations: EBF, exclusively breastfeeding; FF, any formula feeding; PBF, partially breastfeeding.

^aChi-square tests of independence.

^bHigh income is AUD\$900 or more weekly. Low income is AUD\$899 or less weekly.

infant, that is, an additional 6.6 hours weekly compared to mothers who had introduced other foods or nonhuman milks. The mothers who had introduced formula or solids (PBF or FF) spent an additional 1.4 to 2.5 hours per week feeding solids compared to exclusively breastfeeding mothers. The above were statistically significant differences. Time spent preparing feeds (formula, solids, or expressed breast milk) was 0.4 to 1.4 hours per week, and the difference between the 2 feeding groups was just significant. Exclusively breastfeeding mothers of infants spent less time than other mothers preparing feeds or feeding solids.

The difference between the 2 groups in the time spent on the total of feeding activities was not statistically significant, though in the expected direction.

Time spent by others in caring for or feeding the infant and employment-related time constraints were also compared for the 2 feeding groups.

Table 3 shows the resources provided by family or others with the time demands of an infant. Exclusively breastfeeding mothers experienced less help than the other mothers with feeding, and this difference was statistically significant.

Differences in help with care of the infant and time being mainly responsible for the infant's care were not statistically significant.

Table 4 examines employment-related factors to see if differences in these factors could explain the higher time spent by EBF mothers. The differences in labor force participation patterns and employment hours were not statistically significant.

Table 5 summarizes a 1-way between-groups ANOVA for the 3 feeding groups. There were statistically significant differences in milk feeding times, solid feeding times, and food preparation times for the 3 feeding groups: for milk feeding, $F(2, 131) = 7.06$, $P = .001$, for solid feeding, $F(2, 131) = 19.46$, $P < .001$, and for food preparation, $F(2, 131) = 7.20$, $P = .001$. Exclusively breastfeeding mothers spent significantly more time than mothers in the other 2 groups in milk feeding. On the other hand, EBF mothers spent significantly less time than mothers in the other 2 groups in solid feeding and the preparation of feeds.

The differences between the groups in total food preparation time were not statistically significant ($P = .196$), though again the trends in these differences were in the expected direction.

Discussion

Our study contributes unique new evidence on the time investments of mothers in EBF. Our key findings relate to the substantial time taken for exclusive breastfeeding at around 6 months (18.2 hours weekly, or 2.6 hours daily) and the much lower time spent on feeding activities among mothers who had commenced weaning from EBF by introducing solids or formula.

Our analyses revealed that the time demands on EBF mothers for milk feeding were particularly high, and considerably more than for the breastfeeding mothers who had introduced solids, as well as compared to those who had introduced formula.

Our study is strengthened by our comprehensive and detailed maternal time use data for infants age 6 months, which allows rare comparisons by infant feeding status. Previous studies of maternal time costs do not address the exclusivity of breastfeeding or the age of the infant,¹⁵ and those addressing infants' time use typically collect a very narrow range of activity data in order to examine specific activities such as playing, sleeping, or crying.⁵⁷

It is relevant, however, to compare our results with results from an analysis of time use diaries filled out by the caregivers of almost 3000 LSAC (wave 1) Australian infants and young children. In that study, breastfed infants ages 5 to 6 months spent around 3 hours per day (21 hours weekly) on breastfeeding.⁵⁵ The higher figures compared to this study may be because the infant's time use was measured in 15-minute blocks in LSAC time use diaries rather than continuously, and some breastfeeding time may have been categorized slightly differently; for example, in the TUSNM, time spent feeding the infant to sleep or

Table 2. Time Spent on Infant Feeding Activities at Infant Age 6 Months by Feeding Group, Mean Weekly Hours^a

Feeding Activity	EBF	PBF or FF	EBF (Log transformed data)	PBF or FF (Log transformed data)	Mean Difference (Log transformed data)	P Value
Milk feeding	18.2	11.6	2.83 (0.243)	2.43 (0.22)	-0.401	.002
Solids feeding	0.1 ^b	2.5	0.079 (0.063)	1.09 (0.379)	1.01	< .001
Preparing feeds	0.4	1.4	0.211 (0.164)	0.559 (0.408)	0.348	.04
Total	18.7	15.4	2.811 (0.216)	2.645 (0.198)	-0.166	.18

Abbreviations: EBF, exclusively breastfeeding; FF, any formula feeding; PBF, partially breastfeeding.

^aTwo-sided t tests on log transformed data (variances in parentheses).

^bThe non-zero value appears to be measurement error due to a small number of EBF mothers pressing an incorrect time tracking device button.

Table 3. Time Contributed to Care of Infant at Age 6 Months by Others by Feeding Group, Mean Weekly Minutes^a

Type of Care	Exclusive Breastfeeding	Not Exclusive Breastfeeding (PBF or FF)	Exclusive Breastfeeding (Log transformed data)	Not Exclusive Breastfeeding (PBF or FF) (Log transformed data)	Mean Difference (Log transformed data)	P Value
Help with infant feeding	9	35	0.516 (1.79)	2.05 (3.99)	1.532	.003
Help with infant care	324	235	3.98 (8.35)	3.84 (6.16)	-0.137	.839
Time mother not responsible for infant	88	341	2.212 (7.51)	3.536 (8.44)	1.325	.142

Abbreviations: FF, any formula feeding; PBF, partially breastfeeding.

^aTwo-sided t tests on log transformed data (variances in parentheses).

Table 4. Employment Factors by Feeding Group^a

Employment Factor	Exclusive Breastfeeding (n = 16)	Not Exclusive Breastfeeding (PBF or FF) (n = 123)	Exclusive Breastfeeding (Log transformed data)	Not Exclusive Breastfeeding (PBF or FF) (Log transformed data)	P Value
Labor force participation					
Not in labor force	13	89	NA	NA	.449
Employed full-time or part-time or unemployed	3	34			
Employment (average weekly hours)					
Maternal	6	4	0.821 (1.764)	0.808 (1.307)	.969
Paternal	38	40	3.415 (1.196)	3.411 (1.265)	.99
Hourly wage of husband, AUD\$	31	24	2.997 (1.053)	3.186 (0.978)	.557

Abbreviations: FF, any formula feeding; NA, not available; PBF, partially breastfeeding.

^aChi-square tests of independence for labor force participation. Two-sided t tests on log transformed data (variances in parentheses) for hours and wages data.

breastfeeding at nighttime while the mother was sleeping could be recorded as “holding or cuddling” or “sleeping” rather than “breastfeeding.”¹⁹ This highlights that not all time spent breastfeeding is perceived or experienced as costly by mothers.^{15,16}

Our findings on the maternal time costs of breastfeeding for infants age 6 months can also be compared with the time spent by breastfeeding mothers of very low birth weight newborn infants in the neonatal intensive care unit, which averaged around 1.6 hours per day (11.4 hours weekly).⁵⁴

The greater time spent in feeding by EBF mothers may be explained by differences in burden sharing within the household. We explored whether the additional time spent on exclusive breastfeeding was related to differences in

the amount of help received from others in the family, for feeding or for caring for the infant. As exclusively breastfeeding mothers had less help with feeding than the other mothers, premature weaning may be a maternal response to excessive time stresses of infant care or a strategy to share the time costs of infant feeding with others.

Study Limitations

The TUSNM sample is self-selected and results may not be generalizable to other populations of new mothers. However, no population-based, randomly selected sample is available in Australia or elsewhere with comparable data on maternal time use and infant feeding status.

Table 5. Comparison of Feeding Activities by Feeding Group^a

Feeding Activity	N	Mean Weekly Hours	Mean Weekly Hours (Log transformed)	Least Significant Difference	F(2, 131) Statistic (P Value)
Milk feeding					
FF	18	9.2	2.22	.273	7.06 (P = .001)
PBF	101	12.0	2.47		
EBF	15	18.2	2.83		
Solid feeding					
FF	18	2.7	1.11	.343	19.46 (P < .001)
PBF	101	2.5	1.08		
EBF	15	0.1	0.079		
Preparing feeds					
FF	18	2.3	0.97	.348	7.20 (P = .001)
PBF	101	1.3	0.49		
EBF	15	0.4	0.21		
Total					
FF	18	13.9	2.53	.260	1.65 (P = .196)
PBF	101	15.7	2.67		
EBF	15	18.7	2.81		

Abbreviations: EBF, exclusively breastfeeding; FF, any formula feeding; PBF, partially breastfeeding.

^aAnalysis of variance. Log transformed data.

Statistical significance was tested setting $\alpha = .05$, but our study sample may have insufficient power to detect small differences between the feeding groups at this level, there being no evidence on expected effect size to allow power calculations. Hence, it is possible that there are differences between feeding groups that would be found to be significant in a larger sample.

The power of our study to explore the effects of unmeasured confounding variables is also limited by the sample size. Nevertheless, at a broad level, we found no statistically significant difference in the main socio-demographic variables including maternal education or labor force participation between the exclusive breastfeeding and nonexclusive breastfeeding groups.

We used an electronic rather than diary method for time use data collection. This meant that while electronic time tracking accurately records the main categories of activities of mothers with infants compared to the conventional diary method used by the ABS TUS,⁵⁸ secondary activities (simultaneous activities or multitasking) were not counted. All time use data collected are for “main activity” only; secondary child care activities and overlap with main activities are presented and discussed elsewhere.⁵⁸ This may influence the outcomes if mothers in different feeding groups differentially conduct secondary activities while also engaging in feeding activities. Relatedly, our results may underestimate time spent in breastfeeding, if participants recorded nonnutritive sucking time as soothing the infant rather than feeding the infant.¹⁹ Further research is needed on whether there are significant differences in maternal time spent on emotional care of the infant for different infant feeding practices.⁵⁹ We considered only infants age 6 months: evidence on how maternal time

costs of such infant care activities change if their infants are younger or older than 6 months is currently lacking.

Our data are also limited to mothers’ reports of time contributions by other family members, as our survey was designed to measure only maternal time use. Further research measuring both maternal and paternal time use in larger samples would be useful to further explore the resourcing of exclusive breastfeeding time by income and workload sharing within families.

Conclusion

Maternal time spent in various feeding-related activities is high, around 16 to 19 hours per week for a 6-month-old infant. This high time cost of feeding an infant is not commonly recognized or acknowledged. Mothers of infants manage the intense time demands of infant care in various ways, including by introducing formula or solids, obtaining breast milk from other mothers including wet nurses,^{60,61} or sharing the care of the infant with other household members or child care services.

Exclusive breastfeeding is particularly time intensive for mothers. This may contribute to premature weaning for women who are time-stressed, get little assistance with care of the infant or other children from family, or cannot afford paid help including suitable child care. Mothers may also deal with these high time demands through spending less time on personal needs such as sleeping, reducing their leisure time or other activities, or intensifying activity such as by multitasking.^{62,63}

Gaining the public health cost benefits of exclusive breastfeeding may require policies giving mothers more time for breastfeeding. This could include, for example, funding

and promoting strategies such as additional help from others with housework or caring for the infant or other children, enhanced paid or unpaid maternity leave, and lactation breaks in workplaces or onsite child care to reduce the time pressures on mothers at work.

The introduction of a publicly funded scheme for 18 weeks' paid maternity leave in Australia from January 2011 is an initiative that seems well oriented toward improving the economic and social welfare of mothers and babies, especially among those women facing economic constraints on maintaining breastfeeding.

Nevertheless, it remains to be seen whether this will enable more breastfeeding and improved maternal and child health and well-being as expected by the scheme's advocates. Societal sharing of the time costs of exclusive breastfeeding and infant care through paid parental leave needs to also translate into greater resourcing of new mothers within households, so as to relieve time pressures on new mothers at a time when these pressures are at their family lifecycle peaks. For example, efforts to encourage fathers to contribute more equally to unpaid work and child care burdens could be expected to facilitate increased exclusive breastfeeding by giving mothers more time to breastfeed. However, this paternal assistance needs to be focused on the care of the infant, on reducing the unpaid domestic work, on other child care, or on reducing the paid employment hours expected of the mother.

Policies promoting "breastfeeding friendly" child care arrangements are also crucial to reducing maternal time trade-offs of infant care without detriment to breastfeeding among working mothers.⁶⁴

Declaration of Conflicting Interests

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Note

1. The TimeCorder is Canadian technology of workplace productivity consultant Pace Productivity.

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