

# *Where are the Babies? The spatial distribution and mobility of Indigenous Infants in the Northern Territory*

*(Issue No. 201306)*

© The Northern Institute, 2013: This material is submitted for peer review. Correct citation is necessary.

## **KEY FINDINGS**

- There are around 1,500 Indigenous births each year in the Northern Territory, with around three quarters of these outside of Darwin in remote and very remote areas.
- Across a range of health measures, Indigenous mothers and babies fare comparatively poorly. Consequently, it is government policy to transport expectant mothers to larger towns with maternity hospitals prior to birth.
- Census data provides insights on the mobility and migration of Indigenous mothers and infants associated with transport to maternity hospitals in Darwin, Katherine, Tennant Creek, Alice Springs and Nhulunbuy.
- Globally, enumerating infants in collections like the Census is difficult due to issues of undercount, mobility and a failure to record the child's correct age.
- We examined spatial variations in the ratio of infants (0-2 years old) to young children (4-6 years old) and the temporary migration of mothers to and from remote communities.
- We found there were approximately 450 fewer babies across the Northern Territory than would be expected if the ratio of infants to young children was at 0.90 as anticipated in the literature.
- These were 'missing' exclusively from remote and very remote areas and most of the 21 remote Indigenous communities examined had a much lower ratio, with as many as 30-60 missing from individual communities.

## **RESEARCH AIM**

*To explore the mobility and migration of Indigenous mothers and their infants associated with transport to towns with maternity hospitals from remote Indigenous communities. We will examine Census data for an 'excess' in the five towns with a maternity hospital and a 'deficit' at remote Indigenous communities and also look at the mobility and migration patterns of mothers who recently gave birth.*

*This research was conducted by **Dean Carson, Victoria Berger** and **Andrew Taylor**. The research was supported by the Northern Territory Department of Regional Development and Women's Policy. All opinions and findings are of the authors.*

## **1. BACKGROUND**

On average, around 1,550 Indigenous babies are born in the Northern Territory (NT) each year (Australian Bureau of Statistics, 2011), comprising around 40% of all births in the Territory compared to just 5% for Australia as a whole. Births are the most significant contributor to population growth in the NT, and the impacts of births are most significant for remote Indigenous communities where migration has (to date) played a limited role in population change and redistribution. Around three quarters of all Indigenous births are thought to occur outside of Darwin in remote and very remote areas where Indigenous communities are found (author calculations from Northern Territory Treasury, 2013). Indigenous mothers in the NT have higher fertility rates, a lower median age, lower rates of antenatal care, much higher rates of smoking, double the rate of preterm births, double the rate of low birth weight births and much higher rates of induced births compared to their non-Indigenous counterparts (Northern Territory Department of Health, 2012).

With long distances between the many small discrete Indigenous communities and the five maternity hospitals located in the large population centres of Darwin, Katherine, Tennant Creek, Alice Springs, and Nhulunbuy, Northern Territory Government policy is to transport expectant mothers to one of these hospitals before the birth is due (up to three or four months in some cases). If the woman or child is deemed 'at risk' they may also be kept at or near one of the major hospitals for significant periods of neo-natal care and some even transported interstate. The outcome of this mobility is that Indigenous women, particularly from remote communities, can be away from home for substantial periods of time before and after giving birth (Kildea 2006). Understanding the spatial distribution of infants across a jurisdiction such as the NT is critical for modelling local level population changes, and for planning a range of health and community services.

In this brief we provide results from investigations into the extent to which the mobility of Indigenous infants and mothers is revealed in the 2006 Census data. The expectation is that the Census would show a relatively high proportion of infants (0, 1 and 2 years of age) 'resident' in the locations where maternity and neo-natal hospitals are, particularly the larger ones in Darwin, Katherine and Alice Springs where there are more extensive neo-natal care facilities. We would also expect to see infants 'back' at remote communities as they reach older ages. In most cases, infants should be accompanied by their mothers, so there should also be evidence of migration of women of child bearing age between remote communities and hospital centres.

Census data should, in theory, provide valuable insights into the mobility and migration flows of mothers and infants who are away from remote communities. Census definitions would, for example, see those away for six months or more as 'residents' of the centre where they are staying. Conversely, their babies would not be considered residents of the source communities until they have been repatriated. In practice, however, Census data has important limitations when it comes to documenting Indigenous mobility and Indigenous enumeration issues more broadly (Taylor et al., 2011). This research examines how these limitations play out in the context of the spatial distribution of infant's mothers in the NT. It also provides further

understanding about the diverse, detailed and localised flows of Indigenous Territorians and highlights the interplay and distance between the statistical concepts and methods used to measure these phenomena and the situation(s) which eventuate ‘on the ground’.

## **2. WHY FINDING AND COUNTING BABIES IS DIFFICULT**

Despite, or perhaps because child birth is one of the most closely monitored demographic behaviours in many jurisdictions around the world, accurate recording of how many infants there are in a population, and where they are resident is an ongoing challenge. Two reasons for this are high levels of under-enumeration in official data sets (O’Hare 2009), and the extent to which having a child is a trigger for migration of parents and other family members (Kley 2011). Under-enumeration may arise from limitations in the data collection process, particularly the difficulty that many survey respondents have conceptualising their child as ‘0’ years old (O’Hare 2009). In other cases, there may be a range of reasons for people not wanting to report the existence of infants – including a fear of repercussions if the child was born outside of wedlock or in violation of social or legal standards (the most famous example being China’s ‘one child’ policy (Cai 2008)). Many children are also born to parents who themselves are in age groups where enumeration is difficult (Martin et al 2002), and there are higher proportions of infants in under-privileged and migrant populations living in densely populated urban environments – all of which are considered ‘hard to count’ contexts (O’Hare 2009).

The extent of under-enumeration differs from jurisdiction to jurisdiction. Indeed, in China it is estimated that as many as 25% of children aged 0-4 years are not included in official data sets (Goodkind 2004; Cai 2008) while in the United States, under-reporting of this age group at the 2000 Census was estimated to be around 4% (O’Hare 2009). Mobile populations are also difficult to enumerate (Prout 2009), and there is substantial mobility associated with maternity. Mothers may be required to temporarily leave home to access specialist medical care for themselves and their baby, and young families may make the decision to move more permanently to improve their access to ongoing health care (Ssengonzi et al 2002), access to family members who can provide child care and other support (Lerret 2009), or because a new child gives families a renewed focus on quality of life (Kulu 2008; Kley 2011).

Describing the spatial distribution of infants within a jurisdiction is an even greater challenge because of mobility, the spatial clustering of ‘hard to count’ contexts as noted by O’Hare (2009) and the spatial and temporal clustering of birth events (Norman et al 2008). While there is a general ‘rule of thumb’ that there should be marginally more 0 to 2 year old children than 4 to 6 year old children in a large population (O’Hare 2009), this rule may not apply in smaller, localised populations (Norman et al 2008) where there can be substantial temporal variation in the number of births. Nevertheless, Norman and colleagues’ (2008) analysis of age distributions of small area populations in England, Scotland and Wales showed a tendency for there to be at least equivalent numbers of infants (0-2 years old) as young children (4-6 years old), with most areas having higher numbers of infants than young children.

Another issue in relation to understanding the number of infants and babies is the issue of age ‘clumping’ (also known as age ‘humping’ ‘heaping’ or ‘rounding’) (Ayiomamitis 1985; Baten et al 2010). Age clumping generally refers to the tendency for survey respondents (and data collectors generally) to round off their age to the nearest ‘0’ or ‘5’ (such that, for example, someone aged 36 claims to be 35, or someone aged 39 claims to be 40). The most common effect is to shift ages ending in ‘1’ or ‘9’ to the nearest ‘0’ value (Ayiomamitis 1985), and while this is twice as common as shifting to figures ending in ‘5’, there are still noticeable effects in terms of the expected and observed frequencies of ‘4’, ‘5’ and ‘6’ ages within populations (Baten et al 2010).

These issues of under-enumeration, mobility, and age clumping make it challenging to describe the spatial distribution of infants within a jurisdiction, and are likely to be particularly acute for the Indigenous population of the NT. Across Australia, Indigenous people were nearly five times more likely to not be counted in the 2006 Census as their non-Indigenous counterparts (Australian Bureau of Statistics 2006a). Evidence for the undercounting of infants at the local level in the NT is sparse. Taylor (2010) noted that there were more baptisms performed in the community of Wadeye than there were births recorded by the local health centre, but this is not necessarily proof of under-reporting of births to the health centre as baptisms can occur with older children, children may have been born to women in another community but be baptised in Wadeye etc.

Meanwhile, Steenkamp and colleagues (2012) reported discrepancies in births as recorded in three different data sets (local health centre, birth registrations data, and perinatal counts) for two specific communities in the NT. In both cases, local health centres recorded as many as 20% more births than either of the other data sources. This is consistent with Johnstone’s (2011) observations of substantial discrepancies between various data sources purporting to capture all (or nearly all) births in the NT and her conclusion that each data set achieves only partial coverage. Johnstone (2011) provided some regional analysis of data issues and the differing evidence for demographic transition in Darwin as compared to the rest of the NT. Johnstone suggested that there were higher fertility rates outside of Darwin, but that analysing data at a regional level was problematic because of the difficulties in accurately defining the ‘usual residence’ of mothers and their babies given the high levels of mobility.

The mobility of Indigenous people in the NT has long been considered a problem in terms of its impact on accurate Census and small area counts (Morphy et al 2007). Mobility may be a problem for accurate enumeration of infants (via Census or other data sets) because it makes them ‘hard to count’ (for example, Prout’s (2009) claims that infants travel with their ‘itinerant’ parents) and because it is difficult to conform the population to concepts such as ‘place of usual residence’ that are needed for spatial analysis (Taylor 2009). Steenkamp and colleagues (2012), for example, found around 10% of births in the communities they investigated were to ‘visitors’, but that distinguishing between ‘residents’ and ‘visitors’ was often difficult and likely to partially explain discrepancies between births data sets. The other significant issue that appears to be relevant for the NT is the ‘hiding’ of infants who were born outside of the hospital system. While hospital based births account for over 90% of recorded births to Indigenous women in the NT (Kildea 2006), there is some evidence that some women avoid the formal health system

altogether so they do not need to travel away from home to give birth, and they can access community based and traditional forms of birthing practices and neo-natal support (Ireland et al 2011).

Just how long Indigenous women in the NT are away from home if they do engage in the formal health system for child birth is difficult to assess, and varies from individual to individual. In general, women are transported to hospital at 38 weeks of gestation (Ireland et al 2011), but may be transported earlier if they are deemed 'at risk'. Having pregnant women in closely supervised care for longer periods of time is one of the tenets of health care policy in the NT, albeit a hotly disputed one (Hunt 2006). The justification for 'forced' migration for child birth is the high levels of health risks to which Indigenous mothers and their babies are exposed at the home community. While there is some information about what this means for periods away from home before giving birth, the situation after giving birth is much more complicated (Bar Zeev et al 2012). Primary neo-natal care may require hospitalisation for a period of a few days or a few weeks, but once Indigenous women and their children are 'captured' by the higher level health systems in the larger urban centres, they may be encouraged to stay longer for treatment for other conditions or risks (Hunt 2006).

Research into mobility and birthing among Indigenous populations of the NT has had a strong focus on interviewing women who have been 'repatriated' to their home communities. There has been very little consideration of the extent to which relatively long periods away from home (possibly stretching into years when considering pre-birth, neonatal, and additional confinements) might result in more permanent moves away from the community of origin. Some degree of failure to repatriate should be expected simply on the basis of migration theory which suggests that exposure to a place increases the likelihood that place will be selected as a future 'permanent' residence (Behrman and Smith 2010). Certainly, Indigenous women who are away from home for long periods may establish new social networks and support structures in the destination (including those who have accompanied them from the origin community and existing or new contacts in the destination community) and some women may grow to prefer these structures to those available in the origin community (for example, Taylor's (2011) discussion on 'female flight' from remote communities). Capturing these events in the context of a Census is not straightforward because the transition from one 'residence' to another is gradual and not well suited to questions about 'where did you usually live' a certain period of time ago (the Australian Census asks for one year and five years ago). Infants involved in this transition may legitimately have no 'usual residence' having not been to the community of origin, but having not yet settled 'permanently' in the location in which they were born.

This discussion highlights the poor understanding of how many Indigenous infants there are in the NT, where they are, and how their existence is influencing the broader migration systems of Indigenous people of all ages. These are by no means trivial questions, particularly in the context of current provincial and national government policy interventions which are ostensibly focused on improving living conditions and life prospects for Indigenous children in the NT (for example, the Northern Territory Emergency Response (Taylor and Carson 2009) and various initiatives associated with 'Closing the Gap' in an Indigenous disadvantage policy platform). With these issues in mind, this brief proceeds to examine 2006 Census data relating to Indigenous

infants in the NT to shed some light on the ‘how many’ and ‘where’ questions in particular. A focus is on seeking evidence for the movement of infants, and their mothers, from the locations where there are maternity hospitals to remote communities.

### 3. METHODS

Data were drawn initially from the 2006 Census and included age and place of usual residence for ‘infants’ and ‘young children’. ‘Infants’ were defined as aged 0-2 years old (to compensate for the potential ‘age zero’ problem where parents are reluctant) and ‘young children’ as 4-6 years old (to compensate for potential age clumping at age 5). ‘Usual residence’ is intended to refer to the location where the person will live for the longest period of time during the Census year. The ‘usual residences’ considered in this research were: the NT, Darwin (statistical division), Northern Territory Balance (statistical division), and the NT’s Urban Centres and Localities (UCLs) which are discrete population centres of more than (usually) 200 people. The focus for the latter was the former Northern Territory Growth Towns which, subsequent to the removal of the policy which established them, we now term ‘service centres’. All 21 service centres were classified as UCLs in the 2006 data, as were the locations of the five maternity hospitals.

The primary indicator used in the research was the ratio of infants to young children as proposed by Norman and colleagues (2008). Explanations for spatial variation in ratios were examined through comparisons of 2006 Census recording of locations where people were actually enumerated and where they were usually resident. This analysis was intended to reveal whether substantial numbers of infants and/or young children were absent from their ‘usual residence’ on Census night and whether the spatial distribution of infants and young children, according to where they were enumerated, accounted for ‘unusual’ infant/ young children ratios. Spatial variation in ratios was also explored through analysis of Census migration data. One year previous migration data were analysed for infants (1-2 year olds only, because 0 year olds were not usually resident anywhere one year previous) and young children to examine whether, for example, infants had moved away from low ratio locations, or young children had moved into those locations (which would help explain those low ratios).

Data on the spatial distribution of ‘Indigenous mothers’ (defined as Indigenous women of child bearing age of 15-44 years who indicated on the Census that they had had at least one child) were then analysed. The research investigated whether differences in the place of enumeration and place of usual residence of these women favoured high ratio locations (i.e. more Indigenous mothers were enumerated in high ratio locations than were usually resident there). The research also investigated whether Indigenous mothers had migrated from low ratio to high ratio locations, and vice versa, in the previous one or five years.

While Census data is regularly criticised for its limitations in describing the mobility of Indigenous populations of the NT (Morphy et al 2007), it remains the most comprehensive data set available and is a key data set informing policy makers and funding agencies. By extending the work of Johnstone (2011) to look at the reported ‘usual residence’ of infants in the NT in particular, this research makes an important contribution to debates about child birth policy, infant enumeration,

and Indigenous mobility. It also informs policy makers' capacity to interpret Census data to assist in local level planning. At the time this research was conducted, detailed data from the 2011 Census were not available, however we conducted some preliminary analysis of the 2011 data to investigate the extent to which the 2006 0-2 year old cohort changed in its size and spatial distribution for 2011. The analysis will be made available in the near future.

## 4. RESULTS

Based on the calculations shown in Table 1, there were at least 450 fewer infants across the NT than would have been expected if there was a minimum 0.90 ratio between infants and young children. Moreover, all of these were 'missing' from outside of Darwin. While there were more Indigenous infants enumerated in Darwin than identified as usually resident there, and fewer enumerated in the rest of the NT than identified as usually resident there, the differences were small (an extra 16 infants in Darwin, for example) and the pattern was similar for 4-6 year old children as for 0-2 year old children.

**Table 1:** Number of 0-2 Year Old and 4-6 Year Old Indigenous People by Region of Usual Residence, Northern Territory, 2006

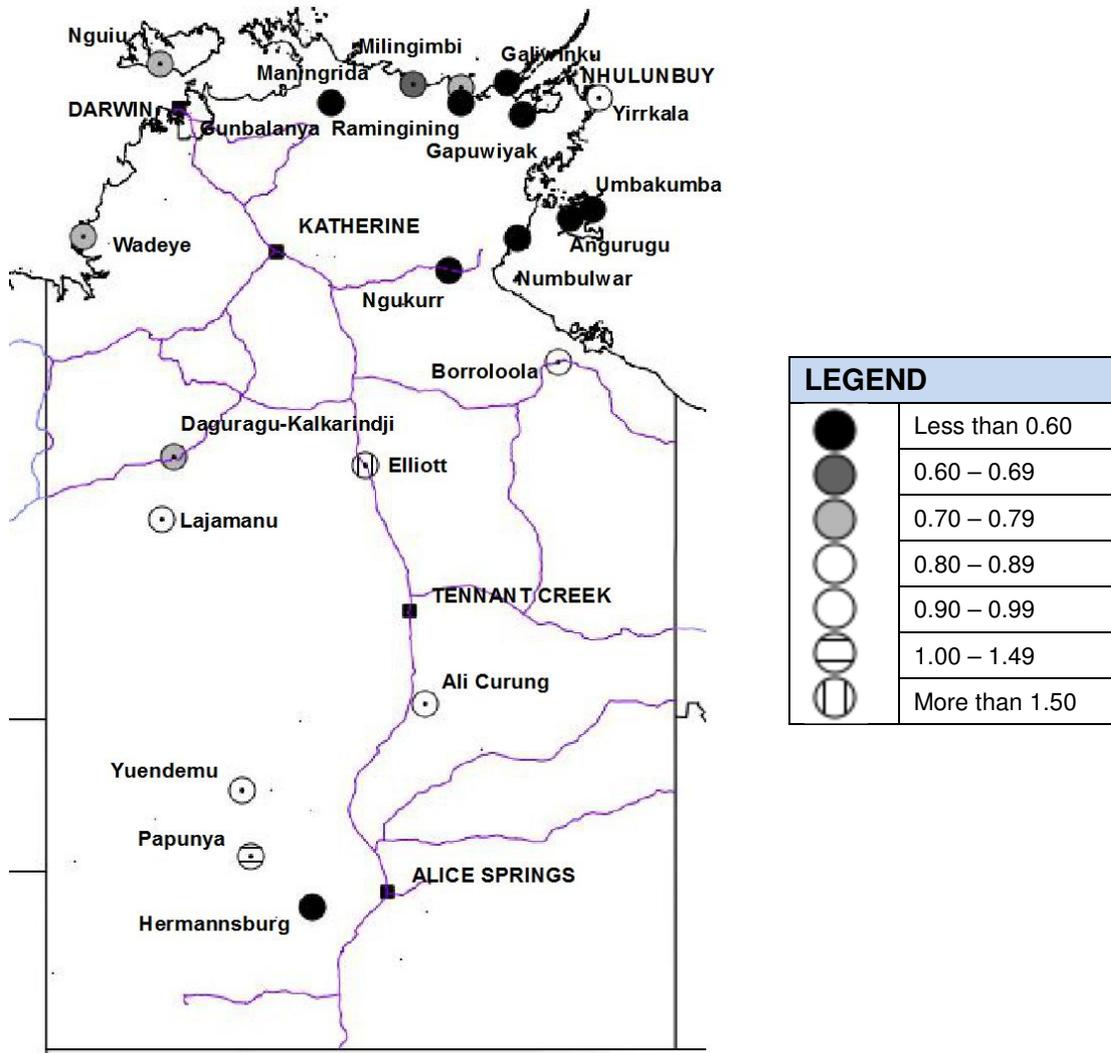
2006 Census counts	Number of 0-2	Number of 4-6	Ratio
Usual Residence Northern Territory	3356	4223	0.79
Place of Enumeration Northern Territory	3364	4237	0.79
Usual Residence Greater Darwin	716	765	0.94
Place of Enumeration Greater Darwin	732	798	0.92
Usual Residence Rest of Northern Territory	2640	3458	0.76
Place of Enumeration Rest of Northern Territory	2632	3439	0.77

Source: ABS Table Builder, custom tables constructed by the authors.

Two of the maternity hospital centres, Katherine (1.03) and Alice Springs (1.02), had larger numbers of 0-2 year old children than 4-6 year old children. Tennant Creek (0.81) and Nhulunbuy (0.75) did not, but these are smaller hospitals with more limited services and consequently may not have as many long stay maternal and neonatal patients.

Only two of the service centres – Elliott (1.86) and Papunya (1.40) – had larger numbers of 0-2 year old children than 4-6 year old children. There were only five additional service centres which met even a conservative benchmark for 'normal' ratio of 0.8. None of these had a ratio higher than 0.87 (Ali Curung), and a number of Growth Towns had ratios below 0.6. (Figure 1).

**Figure 1:** Ratio of 0-2 Years to 4-6 Years Indigenous Children in NT Service Centres, 2006



Extrapolating these ratios using a conservative ‘normal’ ratio of 0.9 suggests 320 ‘missing’ infants in the 21 service centres, with as many as 30-60 ‘missing’ infants in specific locations including Angurugu, Gunbalanya, Maningrida, Ngukurr, and Numbulwar. There were about twice as many 1 and 2 year old Indigenous children (20) who were usually resident in the rest of the NT in 2005 who became usually resident in Darwin in 2006, as there were 1 and 2 year old Indigenous children who were usually resident in Darwin in 2005 and in the rest of the NT in 2006 (9). The very small numbers who changed usual residence between 2005 and 2006 meant that more detailed spatial analysis of infant migration patterns was not warranted.

‘Missing’ infants is one explanation for unusually low ratios of infants to young children across the NT. An alternative explanation would be an excess of young children (4-6 year olds) which may come from in-migration of that age group to non-hospital centres from elsewhere in the NT, or from outside of the NT. But migration data from the 2006 Census do not support such an explanation. There were consistent flows of children of all ages from 1-9 years from remote communities to Darwin (and to a lesser extent to Alice Springs and Katherine) between 2005

and 2006. On a net basis, Darwin received about 30 more 4-6 year old Indigenous children than it gave out to the rest of the NT. In addition, Darwin received a volume of 4-6 year old Indigenous children from outside of the NT equivalent to 17% of its 2006 resident population (about 40 in-migrants). The remainder of the NT received less than 3% of its 2006 population (about 30 in-migrants).

About 14% of Indigenous mothers usually resident in Darwin in 2006, had been usually resident somewhere else in the NT in 2001 (148 individuals). However, just 81 individuals had moved from Darwin to somewhere else in the NT over the same period of time. There was very little difference in migration rates into and out of Darwin between these Indigenous women and Indigenous women of the same age who had not had any children. Half of the women who did move out of Darwin moved to another maternity hospital centre, with no more than 4 or 5 women moving to any other single NT location. Movement in to Darwin was more spatially diverse. Just 41 of the 148 migrants into Darwin had come from other maternity hospital centres, and there were migrants in from virtually every other location across the remainder of the NT. This broad pattern of limited migration to less populated areas (including those NT service centres which were also Statistical Local Areas and migration from a range of less populated areas to Darwin in particular, was also evident in analysis of migration between 2005 and 2006, with the volume of migration about half that of 2001-2006.

There were 709 more 5-7 year old Indigenous children enumerated in the 2011 Census across the NT than there were 0-2 year olds enumerated in 2006. There were 17 fewer 5-7 year olds in Darwin in 2011 than 0-2 year olds in 2006, meaning 726 additions to the cohort in the remainder of the NT.

## **5. DISCUSSION AND CONCLUSIONS**

On the one hand, the Census data reveals the likelihood that under-enumeration of Indigenous infants is more pronounced outside of Darwin and the other larger hospital centres. There were at least 450 fewer 0-2 year Indigenous children than would be expected in the total NT population based on 'normal' ratios of infants to young children (aged 4-6 years) and taking into account Johnstone's (2011) lack of clear evidence of dramatic reductions in fertility rates over that period. While there would be expected to be substantial small area variation in the ratio of infants to young children, only two Northern Territory Growth Towns had ratios in excess of one, and 13 had ratios less than 0.8. The significance of the issue is emphasised with this local level analysis, with the potential for 'missing' infants to constitute, for example, a full school class in some of the larger towns where they had been repatriated into the population at school age.

While there is this evidence of infants 'missing' from areas outside of Darwin, there is no direct evidence to suggest an excess of infants in Darwin. There may be some evidence for an excess of infants in Alice Springs and Katherine, but the extent to which high infant-young children ratios there compensate for low ratios elsewhere is minimal. Additionally, the Census migration data do not reveal any clear pattern of repatriation of infants to remote locations in the NT.

There is also no evidence of a surplus of 4-6 year old Indigenous children in remote communities, or a deficit of these in the hospital centres (particularly Darwin) which would

provide an alternative explanation for the infant-young children ratios. This is emphasised in the preliminary analysis of 2011 Census which show a dramatic addition to the 2006 0-2 year old cohort in the remainder of the NT. It would be unlikely that this addition (over 700 children) would be accounted for by migration within or into the NT given the small volumes of moves that have been recorded in the past. Likewise, there have only been very small numbers of infants who were enumerated in Darwin while claiming to be usually resident in other places, so temporary mobility is also unlikely to account for the changes in this cohort.

Likewise it is difficult to be conclusive about the pattern of movement in and out of hospital centres by Indigenous women who could be the mothers of infants. The volume of moves is relatively small, and the over-riding pattern is movement from the rest of the NT to Darwin - women of child bearing age who have had at least one child move to Darwin from all across the NT. Movement that occurs the other way is focused on the other hospital centres (which are also the larger population centres), with very little migration occurring to smaller population centres.

There were relatively large numbers of Indigenous women of child bearing age who had children enumerated in the hospital centres while usually resident elsewhere and, as with the 'missing' infants, there was a consistent deficit of such women across the Northern Territory Growth Towns. Women in hospital centres to give birth and for neonatal health care is one possible explanation, but there are any number of alternative explanations as suggested by Taylor (2011) such as seeking education or employment. And again, the volumes here are too small to account for the 'missing' infants.

The 2006 Census revealed far fewer Indigenous infants in the NT than would be expected in a 'normal' population. There was a spatial bias to this finding, with infants almost exclusively 'missing' from those places without maternity hospitals. The accepted explanation for missing infants in this context is under-enumeration in the Census (and other data sets). This research reflects in a small way the issue of under-enumeration, raising the issue of whether under-enumeration is occurring in the hospital centres (affecting place of enumeration counts) or the non-hospital centres (affecting place of usual residence counts) or both. The early evidence of 2011 Census suggests children have been 'repatriated' to at least generally the areas outside of Darwin, but it is still unclear whether they were in these areas or not in 2006.

As an overall conclusion this research has found evidence of the displacement of infants from remote communities to the hospital centres (through temporary absences from their places of usual residence), and some evidence that those centres become 'sticky' for some of the displaced (through changes to their place of usual residence). The research has found some evidence that those who are recorded as 'displaced' in these ways in the Census are repatriated to remote areas, but little evidence that the repatriation moves have been recorded. The Census has proven a useful data source in describing the absence of the infant population, but not so useful in describing its reappearance as a young children population, or in describing how the absence from remote areas impacts the population of the hospital centres.

Despite the limitations, the research has contributed to the literature with its insights into spatial bias of under-enumeration of infants, and its consideration of the question of what evidence exists in the Census to document the migration/ mobility of Indigenous mothers and their babies which has unknown impacts on long term population distribution. The research has also contributed to practice, raising awareness of the issue around using existing demographic data

to forecast maternal and child service demand, particularly in remote communities. The advice to policy makers and service providers is that there are likely to be more infants in remote communities than any of the data sets about births and infancy suggest, but also that at least some mothers and infants (and potentially other people accompanying them for child birth) transition from living in remote communities to the larger urban centres. The under-enumeration problem has been well recognised (although not at such a fine geographic level), but the potential for long term movement away from remote communities arising from forced migration for child birth has not.

What is clear is the need for more research into the nature of migration and mobility of Indigenous infants in the NT. The journeys of their mothers have been documented largely as individual stories, and there has been little attention paid to analysing the total length of stay away from communities, and the extent to which repatriation does and does not occur. There has been no analysis of the characteristics of mothers (or babies) which influence length of stay or likelihood of repatriation. There has been no analysis of how the movement of mothers and infants affects the movement of other people, such as fathers, other family members and friends. The Census has limited capacity to address these issues, as we have demonstrated here, and neither do the data sets examined by Johnstone (2011), Steenkamp and colleagues (2012) and others. Consequently there is a need for new primary research that not only illustrates the range of ‘journeys’ of mothers and their babies, but allows some quantification of the impacts of those journeys on population distribution and hence local level service planning.

This research has specifically been about Australia’s NT, but there are clearly some insights here for other jurisdictions where issues of estimation and enumeration of Indigenous children have been identified, such as Canada (Moffitt and Volman 2006; James et al 2010; Kornelson et al 2010). This research also raises some questions about the links between policy and enumeration of infants that have resonance with previous discussions about China (Cai 2008). In the case of China, links have been made between infant under-enumeration and the ‘one child’ policy, and in the case of the NT, there is a suggestion that infant enumeration is linked to maternal health and birthing policies (Kildea 2006). The research contributes to the global discussion about the treatment of young children in statistical data collections (O’Hare 2009). Clearly this is a phenomenon that needs to be better understood particularly in terms of the extent to which local conditions and/ or universal properties explain particular episodes of under-enumeration.

## REFERENCES

- ABS (2011) 3301.0 - Births, Australia, 2011. Accessed 4 September 2013 from <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3301.0>
- Australian Bureau of Statistics (2006a). *Census of Population and Housing - Details of Undercount, Aug 2006*. Canberra: Australian Bureau of Statistics.
- Ayiomamitis, A. (1985). A computer algorithm for the assessment of age reporting bias in censal population estimates using Myers' 'blended' method. *Computer Methods and Programs in Biomedicine* 21:107-111.
- Baten, J, K Manzel, and Y Stolz (2010). Convergence and Divergence of Numeracy: The Development of Age Heaping in Latin America, 17th to 20th Century In *Historical Patterns of Development and Underdevelopment*. Montevideo, Uruguay: Universidad de la Republica, Uruguay.
- Berhrmann, J, and E Smith (2010). Top 7 Issues in Medical Tourism: Challenges, Knowledge Gaps, and Future Directions for Research and Policy Development *Global Journal of Health Science* 2 (2):80-90.
- Cai, Y (2008). An assessment of China's fertility level using the variable-r method. *Demography* 45 (2):271-281.
- Goodkind, D.M. (2004). China's Missing Children: The 2000 Census Underreporting Surprise. *Population Studies* 58 (3):281-295.
- Hunt, J. (2006). Trying to make a difference: a critical analysis of health care during pregnancy for Aboriginal and Torres Strait Islander women. *Australian Aboriginal Studies* 2:47-56.
- Ireland, S, C.W Narjic, S Belton, and S Kildea (2011). Niyith Niyith Watmam (the quiet story): Exploring the experiences of Aboriginal women who give birth in their remote community. *Midwifery* 27:634-641.
- James, S, B O'Brien, K Bourret, N Kango, K Gafvels, and J Paradis-Pastori (2010). Meeting the needs of Nunavut families: a community-based midwifery education program. *Rural and Remote Health* 10: 1355 (online):<http://www.rrh.org.au>.
- Johnstone, K. (2011). Indigenous Fertility in the Northern Territory of Australia: Stalled Demographic Transition?, Australian Demographic and Social Research Institute, Australian National University, Canberra.
- Kildea, S. (2006). Risky business: contested knowledge over safe birthing services for Aboriginal women. *Health Sociology Review* 15 (4):387-396.
- Kley, S. (2011). Explaining the Stages of Migration within a Life-course Framework. *European Sociological Review* 27 (4):469-486.
- Kornelson, J, A Kotaska, P Waterfall, L Willie, and D Wilson (2010). The geography of belonging: The experience of birthing at home for First Nations women. *Health and Place* 16:638-645.
- Kulu, H. (2008). Fertility and spatial mobility in the life course: evidence from Austria. *Environment and Planning A* 40:632-652.

- Lerret, S.M.(2009). Discharge readiness: an integrative review focusing on discharge following pediatric hospitalization. *Journal for Specialists in Pediatric Nursing* 14 (4):245-255.
- Martin, D, D Dorling, and R Mitchell (2002). Linking censuses through time: problems and solutions. *Area* 34 (1):82-91.
- Moffitt, P.M, and A.R Vollman (2006). At what cost to health? Tlcho women's medical travel for childbirth. *Contemporary Nurse* 22:228-239.
- Morphy, F, W Sanders, and J Taylor (2007). Producing powerful numbers. In *Agency, contingency and census process : observations of the 2006 Indigenous enumeration strategy in remote Aboriginal Australia*, edited by F. Morphy. Acton, Australian Capital Territory: ANU E Press.
- Norman, P, L Simpson, and A Sabater (2008). 'Estimating with Confidence' and Hindsight: New UK Small-Area Population Estimates for 1991. *Population, Space and Place* 14:449-472.
- Northern Territory Department of Health (2012). *Northern Territory Midwives' Collection: Mothers and Babies, 2007*. Northern Territory: Department of Health.
- Northern Territory Treasury (2013). Population Projections Interim - Update (2013 Release). Accessed 8 September 2013 from <http://www.treasury.nt.gov.au/Economy/populationprojections/Pages/default.aspx>
- O'Hare, W.P. (2009). Why are young children missed so often in the census? In *KIDS COUNT working paper*. Baltimore, Maryland: The Annie E. Casey Foundation.
- Prout, S. (2009). Vacuums and Veils: Engaging with Statistically 'Invisible' Indigenous Population Dynamics in Yamatji Country, Western Australia. *Geographical Research* 47 (4):408-421.
- Steenkamp, M, K Johnstone, and S.J Bar Zeev (2012). Can we count? Enumerating births in two remote Aboriginal communities in the Northern Territory. *Australian and New Zealand Journal of Public Health* 36 (3):281-284.
- Ssengonzi, R, G.F De Jong, and C.S Stokes (2002). The effect of female migration on infant and child survival in Uganda. *Population Research and Policy Review* 21:403-431.
- Taylor, A, and Carson, D. (2009). Indigenous mobility and the Northern Territory Emergency Response. *People and Place* 17 (1):29-38.
- Taylor, A. (2011). Current evidence of 'female flight' from remote Northern Territory Aboriginal communities – demographic and policy implications. *Migration Letters* 8 (2):77-88.
- Taylor, A., Johns, G., Steenkamp, M., Williams, J.G. (2011). The 'Problem' of Indigenous Migration in the Globalised State, In D. Carson, R. Rasmussen, P. C. Ensign, A. Taylor and L. Huskey (Eds). *Demography at the Edge: Remote human populations in developed nations*. Farnham, England: Ashgate Publishing, 163-188.
- Taylor, J. (2009). Indigenous demography and public policy in Australia: population or peoples? *Journal of Population Research* 26 (2):115-130.
- Taylor, J. (2010). Demography as Destiny: Schooling, Work and Aboriginal Population Change at Wadeye. In *CAEPR Working Paper*. Canberra: Australian National University.