Deloitte Access Economics

Cost-benefit and funding analysis of the Danila Dilba Health Service

Danila Dilba Butji
Binnilutlum Health Service
Aboriginal Corporation

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Glossary

ABS	Australian Bureau of Statistics
ACCORD	Action to Control Cardiovascular Risk in Diabetes
ACE	angiotension converting enzyme
ACR	albumin/creatinine ratio
ACSC	ambulatory care sensitive conditions
ADAT	avoidable deaths amenable to treatment
ADVANCE	Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation
AHKPI	Aboriginal Health Key Performance Indicator
AHP	Aboriginal Health Practitioner
AIDS	acquired immune deficiency syndrome
AIHW	Australian Institute of Health and Welfare
ARB	angiotension receptor blocker
AR-DRG	Australian refined diagnostic related group
ARF	acute rheumatic fever
ARN	Access Relative to Need
BCR	benefit-cost ratio
CKD	chronic kidney disease
CPI	consumer price index
DALY	disability-adjusted life year
DDHS	Danila Dilba Health Service
DOH	Department of Health
DSS	Department of Social Services
FTE	full-time equivalent
eGFR	estimated glomerular filtration rate
GP	general practitioner
HbA1c	glycated haemoglobin
HIV	human immunodeficiency virus infection
IHPA	Independent Hospital Pricing Authority
KDIGO	Kidney Disease Improving Global Outcomes
KPI	key performance indicator

mm Hg	millimetres of mercury
NPV	net present value
NT	Northern Territory
PM&C	Prime Minister and Cabinet
RHD	rheumatic heart disease
ROI	return on investment
UKPDS	United Kingdom Prospective Diabetes Study
VSLY	value of a statistical life year
YLD	years of healthy life lost due to disability
YLL	years of life lost due to premature mortality

Executive Summary

Danila Dilba Health Service (DDHS) is an Aboriginal community-controlled organisation providing culturally-appropriate, comprehensive primary health care and community services to Aboriginal and Torres Strait Islander ("Indigenous") people in the Yilli Rreung (Greater Darwin) region of the Northern Territory (NT). **DDHS is Darwin's only Aboriginal community-controlled health service, and provides services to almost 80% of the Indigenous population in the region.**

Health care services provided by DDHS are focused on acute care, immunisation, chronic disease management, women's health, men's health, child and maternal health, sexual health and dental care. DDHS also provides a range of community programs in areas including health promotion, mental health/social and emotional wellbeing, and alcohol, tobacco and other drugs.

> Deloitte Access Economics was commissioned by DDHS to conduct a prospective cost-benefit analysis of the services provided by DDHS, and to establish whether the funding received by DDHS is appropriate with reference to the characteristics and funding of similar organisations, the funding guidelines it operates under, and its costs of service delivery.

Cost-benefit analysis[1]

The scope of the engagement was limited to considering three elements of DDHS services. The three areas of interest – type 2 diabetes, chronic kidney disease (CKD), and maternal and child health – were chosen as they represented a substantial proportion of the burden of disease in Indigenous people in the NT, that could be measured from the available data. The methodology and parameters used to estimate these benefits are outlined in Chapter 3.

Costs in the analysis were calculated as the cost of DDHS services (measured in expenses per episode of care) minus the average cost of services delivered at other Indigenous primary health care organisations in the NT, also measured in expenses per episode of care.

Benefits of DDHS services were estimated with reference to the health status of DDHS clients in the three areas of interest – type 2 diabetes, CKD, and maternal and child health – minus the health status of NT Indigenous people who did not attend DDHS. The implication of this approach is that areas where DDHS clients have superior (worse) outcomes compared to the non-DDHS population are treated as positive (negative) benefits in the cost-benefit analysis.

[1] A cost-benefit analysis involves the estimation of costs and benefits over a number of years, with future benefits and costs discounted to the present using a discount rate. The costs and benefits of a particular intervention program are compared to determine a net benefit (or cost) along with a benefit-cost ratio (BCR) and a return on investment (ROI).

Table i shows the estimated benefits due to DDHS services in 2015-16 for the three chosen streams.

Table i: Summary of benefits

Benefit stream	Health/ financial	Value of life	Total
Maternal and childhood health	-	0.16	**0.16**
Type 2 diabetes management	0.37	2.33	**2.70**
CKD screening and management	0.06	2.68	**2.74**
Total	**0.43**	**5.17**	**5.60**

Source: Deloitte Access Economics calculations.

Overall, in 2015-16 DDHS services are estimated to contribute $5.60 million in incremental benefits based on improved health outcomes for its clients. This is comprised of $0.43 million in avoided health and other financial costs, and $5.17 million in improved value of life.

As the benefits of DDHS services are incremental to other service providers, it is also necessary to consider the incremental costs of providing these services. To do this, the expenditure per episode of care is compared across organisations in the NT to the expenditure per episode of care for DDHS services. By comparing the cost per episode of care, it was estimated that DDHS incurred $1.34 million in incremental costs providing care to its clients, in 2015-16 dollars.

Table ii presents the results of the cost-benefit analysis. DDHS net benefits were estimated to be approximately $4.26 million for 2015-16. The estimated BCR was 4.18, and the ROI was 318%. These findings show that DDHS services substantially improve quality of life, and avoid health system costs, resulting in overall net benefits to NT (and thus Australian) society.

Table ii: Cost-benefit results

Costs	$1.34 million
Benefits	$5.60 million
Net benefits	$4.26 million
BCR	4.18
ROI	318%

Source: Deloitte Access Economics calculations.
Note: Costs are the incremental costs of DDHS. Benefits are the avoided costs due to DDHS in 2015-16. Net benefits are calculated by subtracting costs from benefits. The BCR is calculated by dividing benefits by costs.

DDHS cost driver and funding analysis

The report analyses the cost drivers of DDHS, as these will impact on DDHS' ability to provide services at a sufficient quality and volume to Indigenous residents of Greater Darwin.

The primary **supply-side cost drivers are staff recruitment and retention, and the cost of doing business in Darwin**. In a survey of northern Australian regions undertaken by the Department of Employment (2015), Darwin was the only region where recruitment difficulty and staff retention were flagged as significant future concerns by employers, with a high proportion of employers reporting recruiting difficulties when recruiting for high skilled occupations. Darwin also experiences low rates of unemployment, which is associated with lower numbers of applicants per vacancy compared to other regions.

The **demand-side cost drivers include population growth, prevalence of chronic disease, mortality rates, proportion of services provided to Indigenous clients, and the rate of homelessness and overcrowding.**

Population growth in the Greater Darwin region is expected to be greater than the rest of Australia for both the general population and Indigenous population. Further, the Indigenous population in the NT has **higher prevalence of chronic disease and mortality** compared to the rest of Australia. **These factors will lead to increased demand for DDHS services.** Other demand side drivers – the proportion of services provided to Indigenous clients, and the relatively large Indigenous homeless population and overcrowding in the NT – are also **increasing the demand for DDHS services relative to the rest of Australia and other areas of the NT**.

The funding comparison collected data from DDHS and similar organisations in the NT. Results were compared across a number of organisations that DDHS selected. All of the chosen organisations have a focus on providing primary health care to Indigenous people. Funding comparisons were made in regards to **funding per staff member, funding per episode of care and funding per Indigenous person in each organisation's target area**.

> The funding comparisons show that DDHS receives less funding per staff member, less funding per episode of care and less funding per person in its target population, than is received by the average comparator organisation. Further, DDHS has observed a decrease in total grant funding since 2011-12. These factors may be negatively impacting on DDHS' ability to deliver high quality services at a sufficient volume to maintain or improve health outcomes in the Greater Darwin population.

Assessment of funding against program guidelines

DDHS receives grant funding from various government programs. Two key selection criteria which are used in allocation funding are **demonstrated need** and **value for money**.

The cost-benefit analysis shows that **DDHS delivers value for money**. The cost-benefit analysis indicated that each dollar invested in DDHS provides $4.18 of benefits to society, and thus each additional dollar invested into primary health care services provided by DDHS provides a strong return.

There is a demonstrated need for Indigenous primary health care in Greater Darwin, and this need is increasing. Between 2011-12 to 2014-15, the number of episodes of care provided by DDHS increased from 39,102 to 58,376, which is an average increase of 12.3%

per year. Analysis by the Australian Institute of Health and Welfare (2014) shows that **Indigenous people in the Greater Darwin region have a low access to GP services relative to their needs**[2].

Conclusion

This report has demonstrated that DDHS delivers superior health outcomes compared to those delivered by comparable health services. As a result of the higher quality service, DDHS' cost per service is also higher, but DDHS receives less grant funding to provide these services. **As DDHS provides superior quality of care, it is reasonable to conclude that, at a minimum, the grant funding given to DDHS should be increased to be in line with the grant funding received by the comparator organisations**.

The grant funding provided to comparator organisations to fund the cost of service delivery is 25% higher in terms of funding per FTE, and 31% higher in terms of funding per episode of care. **Thus, this report recommends that DDHS grant funding be increased by between 25% and 31% – this is an increase of between $3.1 million and $3.9 million**, based on 2014-15 funding levels.

The analysis in this report has shown that there is a **demonstrated need for Indigenous primary health care in Greater Darwin**, and the latest *Closing the Gap* report (released in February 2016) attests to the continuing gap in health outcomes between Indigenous and non-Indigenous Australians.

> Investing additional funding into DDHS would represent a sound investment in improving Indigenous health in the NT, and would assist with further closing the gap in Indigenous health outcomes.
>
> An increase in funding could potentially allow DDHS to continue to meet the existing and growing demand for Indigenous primary health care, while continuing to improve health outcomes and provide cost savings to society.

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[2] The AIHW (2014) assigned an Access Relative to Need (ARN) score for each Statistical Area Level 1 region in Australia (see Section 7.2 for an explanation of this metric). The Greater Darwin region was assigned a score of 1 on the ARN index, which is the lowest possible score on the index, and represents a low access to primary health care relative to need.

1 Introduction

Deloitte Access Economics was commissioned by the Danila Dilba Health Service (DDHS) to conduct a prospective cost-benefit analysis of the services provided by DDHS, and to establish whether the funding received by DDHS is appropriate with reference to the characteristics and funding of similar organisations, the funding guidelines it operates under, and its costs of service delivery.

1.1 Overview of the Danila Dilba Health Service

DDHS is an Aboriginal community-controlled organisation providing culturally-appropriate, comprehensive primary health care and community services to Aboriginal and Torres Strait Islander ("Indigenous") people in the Yilli Rreung (Greater Darwin) region of the Northern Territory (NT). DDHS is Darwin's only Aboriginal community-controlled health service. A diagram of the DDHS service area is shown in Figure 1.1.

Figure 1.1: DDHS service area

Source: DDHS (2015).

The aim of DDHS is to:

> *" … improve the physical, mental, spiritual, cultural and social wellbeing of Biluru people in the Yilli Rreung region through innovative comprehensive primary health care programs, community services and advocacy that are based on the principles of equity, access, empowerment, community self-determination and collaboration" (DDHS, 2016).*

To achieve this aim, DDHS provides culturally-appropriate, comprehensive primary health care and community services, and aims that all clients are treated by Aboriginal Health Practitioners (AHPs) in the first instance prior to being referred to doctors and/or other health professionals.

Culturally appropriate services are likely to have a far greater influence on Indigenous people than services which are not culturally appropriate. Culture influences Indigenous people's decisions about whether they will seek and adhere to treatment, and ultimately the success or failure of the treatment (Department of Health and Community Services, 2007).

Health care services provided by DDHS are focused on acute care, immunisation, chronic disease management, women's health, men's health, child and maternal health, sexual health and dental care. DDHS also provides a range of community programs in areas including health promotion, mental health/social and emotional wellbeing, and alcohol, tobacco and other drugs.

During 2014-15, DDHS had 12,786 clients from the Greater Darwin region and 1,991 visitors[3] from outside the region who accessed DDHS services (DDHS, 2015). Figures supplied to Deloitte Access Economics by DDHS indicate that approximately 94.4%[4] of all clients who have used DDHS services identify as Indigenous, which means that an estimated 12,070 Indigenous clients from the Greater Darwin region used DDHS services in 2014-15. Using an estimated 15,209 Indigenous people who resided in the Greater Darwin region in 2014-15 (NT Department of Treasury and Finance, 2014), **it is estimated that 79.4% of the Indigenous population in the Greater Darwin region used DDHS services in 2014-15**.

1.1.1 Clinic locations and services

DDHS has four locations: the Knuckey St Clinic and the Men's Clinic in the Darwin central business district, the Emotional and Social Wellbeing Centre in Malak (a northern suburb of Darwin), and the Palmerston Health Centre in Palmerston (a satellite city of Darwin).

The **Knuckey St Clinic** provides both primary health care and specialist health care services. Some of the primary health care services provided by the Knuckey St Clinic include health

[3] This includes 1,417 visitors from rural areas within the DDHS service area, and 574 visitors from the rest of the NT.

[4] The remaining 5.6% of clients are non-Indigenous people who have an Indigenous child or Indigenous partner.

checks, acute and chronic disease management, and vaccinations. Specialist services provided by this facility include chronic disease support, eye health services, cardiology services, physiotherapy services, a diabetes educator, endocrinal, respiratory and podiatrist services, and an integrated physiological service across all three clinics. In addition, there is a child health program that operates once per week. Practitioners at this clinic include general practitioners (GPs), visiting specialists, AHPs and registered nurses.

The **Men's Clinic** specialises in men's health and is operated by male health workers. This clinic has a focus on chronic disease detection, prevention, treatment and monitoring, and also performs full adult health checks for every new patient.

The **Emotional and Social Wellbeing Centre** runs a number of community services programs, which include:

- Tackling Tobacco – this program provides support to clients to reduce or quit smoking.
- Alcohol and Other Drugs – this program helps clients deal with the impacts of alcohol and other drugs, access rehabilitation, and develop a treatment plan.
- Emergency Relief Fund – this provides limited emergency relief funds and access to financial counselling to those who experience unforeseen financial emergencies.
- Royal Commission – counselling teams provide support to community members who participated, or plan to participate, in the Royal Commission into Institutional Responses to Child Sexual Abuse.
- Bringing Them Home – this program provides counselling support to Indigenous people who have been affected by past government policies and practices regarding the removal of children from their families.

The **Palmerston Health Centre** is comprised of three main clinics: a women's and family clinic, a general practice clinic and a dental clinic. The women's and family clinic, the Gumileybirra Women's Clinic, is staffed by women and provides services specifically for Indigenous women and children. This clinic provides services such as pap smears, contraception, midwifery and a mothers and babies program. The dental clinic specialises in Indigenous oral health and dental health education. The general practice's main focus is on health assessments and child health. The *Healthy Kids, Stronger Futures* community program was also recently relocated to this centre. This program provides children with health checks and health education to parents and carers of children to help reduce the gap in life expectancy between Indigenous people and non-Indigenous people. The child health service provides a comprehensive suite of services to children including acute, chronic and preventative services, and services addressing mental health and behavioural conditions.

In addition to these fixed health clinics, DDHS also provides **transport services for patients**, and **health services to homeless people through a mobile unit, aimed at re-engaging clients from town camps and those who are homeless**. The transport service operates five days a week and takes eligible clients to and from DDHS facilities. To be eligible, a client must be an Indigenous person, and must either be frail and/or disabled or suffer from a chronic condition that prevents them from using public transport. Carers travelling with eligible clients are also permitted to use the service. The mobile unit provides health care services to homeless Indigenous people living in the Darwin and Palmerston areas, in particular immunisations and referrals.

1.2 Structure of report

The structure of this report is as follows:

- **Chapter 1** presents an overview of DDHS, to provide context and background information for the analysis.
- **Chapter 2** outlines the framework which was used to conduct the cost-benefit analysis of DDHS, and provides an explanation of key economic terms.
- **Chapter 3** presents the data and parameters which were used in the cost-benefit analysis.
- **Chapter 4** contains the results of the cost-benefit analysis, and discusses the findings of economic analyses of other Indigenous primary health care programs.
- **Chapter 5** analyses supply-side and demand-side cost drivers which impact on DDHS' costs of service delivery.
- **Chapter 6** compares the funding received by DDHS with the funding received by similar organisations.
- **Chapter 7** identifies whether the funding received by DDHS is aligned with the principles in the funding guidelines which it operates under.

2 Analytical approach

This chapter describes the methodology for calculating the economic costs and benefits in the cost-benefit analysis, and provides explanations of key economic terms.

2.1 Cost-benefit analysis

A cost-benefit analysis involves the estimation of costs and benefits over a number of years, with future benefits and costs discounted to the present using a discount rate. The costs and benefits of a particular intervention program are compared to determine a net benefit (or cost) along with a benefit-cost ratio (BCR), which is the 'breakeven point' – anything above this point is a net benefit. The BCR is calculated as the ratio of the sum of a program's benefits, relative to the cost of the program. The breakeven point for the BCR is 1, in that a BCR between 0 and 1 represents a net cost, while a BCR above 1 represents a net benefit.

In this analysis, **the economic costs and benefits of DDHS have been estimated for the 2015-2016 financial year**. While it is acknowledged that this report has been finalised before the end of 2015-16, care has been taken to ensure that all estimates for cost-benefit parameters in 2015-16 are based on reliable historical data and projections.

2.1.1 Valuing the attributed economic impact

In valuing economic benefits, studies typically consider one or more of the following streams of benefits:

1. the value to the economy of a healthy workforce;
2. the value to the economy in terms of costs avoided, for example medication that is no longer required; and/or
3. reductions in the burden of disease, which is measured by placing a monetary value on a year of healthy life.

The following assessment primarily uses the third approach, and the second approach is also quantified where possible. To determine the net benefits from DDHS activities, the value of gains in wellbeing need to be monetised so they can be compared to the cost of producing those gains. The value of gains in wellbeing can be calculated by multiplying the value of a statistical life year (VSLY) by the total number of disability-adjusted life years (DALYs). These concepts are explained in the following sections.

2.1.1.1 Value of a statistical life year

The VSLY concept is widely used for the evaluation of public policies in the areas of health, environment and safety. The VSLY represents a trade-off between wealth (budgetary resources for a government decision) and a reduction in the probability of death or morbidity from disease or injury. The VSLY estimates the value society places on reducing this risk, expressed in terms of gaining a healthy life year 'statistically' (that is, not for any

identified person). There are a number of methods used to estimate how much society is willing to pay to reduce the risk of death or morbidity, with examples being:

- asking individuals through a survey what they would pay to save or prolong life;
- observing how much consumers pay for products that reduce the risk of death, illness or injury; and
- observing how much workers are willing to pay (through reduced wages) for an improvement in workplace health and safety.

Based on an average of empirical measures, and the average healthy person living for another 40 years, the Department of Prime Minister and Cabinet (PM&C, 2014) estimates the value of a statistical life is **$4.2 million**, and the **VSLY is $182,000** in 2014 dollars. PM&C recommends that these values are used in all cost-benefit analyses in Australia to value healthy life.

2.1.1.2 Disability-adjusted life years

To calculate the pain, suffering and premature mortality of particular conditions, health economists use DALYs. A DALY is the sum of the number of years of life lost due to premature mortality (YLLs) from a particular condition, as well as the number of years of healthy life lost due to disability (YLDs) living with the condition.

To calculate the DALYs for a particular medical condition, it is necessary to know the disability weight of the condition, as well as the duration of the condition[5]. Estimates for both of these parameters are obtained from publications such as Mathers et al (1999), Stouthard et al (1997), Begg et al (2007), and Murray and Lopez (1996). These publications allow for standard parameters to be used in health policy assessments around the world.

The disability weight is expressed as a decimal between 0 and 1, where 0 represents perfect health and 1 represents death. For example, the disability weight for a broken wrist is 0.18. The duration is expressed as the number of years lived with the condition. For example, a broken wrist may have a duration of 8 weeks, which would equal 0.15 years.

The DALY approach has been successful in avoiding the subjectivity of individual valuation and is capable of overcoming the problem of comparability between individuals and between nations. In Australia a DALY is valued equally for people of all ages.

The particular disability weights and durations which have been used to calculate the economic benefits of DDHS services are presented in the applicable sections in chapter 3.

[5] This report uses both prevalence and incidence approaches to calculate economic benefits, given limitations in data availability. A prevalence approach uses a duration of one year (except when the duration of the condition is less than one year), as the economic burden is calculated for all cases of a condition in a given year. An incidence approach uses a duration that can be any positive value (with an upper limit being the average life expectancy), as the economic burden is calculated based on the number of new cases of a condition in a given year, and the duration of the condition.

2.1.2 Evaluation measures for cost-benefit analysis

There are several evaluation measures that can be used in the analysis of the net benefits delivered by DDHS. The two most commonly used benefit measures are the net present value (NPV) and the return on investment (ROI). This study uses both measures.

The NPV of benefits is also known as the discounted value of the net benefit stream. It is obtained by discounting the stream of net benefits back to its value in the chosen base period, in this case 2015-16. The general NPV formula can be represented by:

$$NPV = \sum_{t-0}^{n} \frac{B_t - C_t}{(1+r)^t}$$

where:

B_t is the benefits from intervention in period t

C_t is the expenditure on intervention in period t

r is the economic discount rate (7%[6])

n is the number of years the benefits from intervention are accrued.

The ROI calculates the net return on an investment, relative to the costs invested, and is expressed as a percentage. The general ROI formula is represented by:

$$ROI = \frac{NPV_B - NPV_C}{NPV_C} \; x \; 100$$

where:

NPV_B is the NPV of the benefits

NPV_C is the NPV of the costs

[6] This discount rate is recommended by the PM&C (2014).

3 Methodology and data

Deloitte Access Economics was engaged to conduct a cost-benefit analysis of DDHS services. The scope of the engagement was limited to considering three elements of DDHS services. The services chosen – largely due to the availability of robust data and because these services treat conditions with a high burden of disease in the target population – were chronic disease management in type 2 diabetes, chronic kidney disease (CKD), and maternal and childhood health services.

This chapter outlines the specific methodologies and data that were used in the cost-benefit analysis of DDHS.

3.1 Methodological approach for assessing the costs and benefits of DDHS services

For this analysis, **the costs and benefits were estimated on an incremental basis**: the DDHS cost of service delivery relative to the costs of service delivery at other Indigenous primary health care organisations, and the health status of DDHS clients relative to the health status among all non-DDHS Indigenous clients in the NT. As such, the comparator is effectively the Indigenous population in the NT that does not access DDHS services.

The **costs** in the analysis are calculated as the cost of DDHS services (measured in expenses per episode of care) minus the average cost of services delivered at other Indigenous primary health care organisations in the NT, also measured in expenses per episode of care. Costs are discussed further in section 4.2.

The **benefits** of DDHS services were estimated with reference to the health status of DDHS clients in the three areas of interest (type 2 diabetes, CKD, and maternal and child health) minus the health status of NT Indigenous people who did not attend DDHS.

> Thus, in areas where DDHS clients have better health outcomes than non-DDHS clients, the DDHS clients have a better quality of life than they otherwise would have had (that is, a lower burden of disease), and the health expenditure for that client (outside the DDHS service) is lower than it otherwise would have been.

The implication of this approach is that areas where DDHS clients have superior health (compared to the non-DDHS population) are treated as positive benefits in the cost-benefit analysis, while areas where DDHS clients record worse health (compared to the non-DDHS population) are treated as negative benefits.

The following sections outline the key data sources for this analysis, the methodological issues with evaluating overall health outcomes, and the need to adjust the calculation of benefits due to DDHS being located in an urban setting, in order to allow for the comparator being based in a rural/remote setting.

3.1.1 NT Aboriginal Health Key Performance Indicator System

The health of DDHS and non-DDHS clients was established using data that are provided by all primary health care organisations in the NT to the NT Aboriginal Health Key Performance Indicator (AHKPI) Information System. The NT AHKPI Information System collects and reports data on key health metrics, which are used to support health services in planning activities and in contributing to evidence-based reporting requirements (NT AHKPI Clinical Reference Group, 2015). For this analysis, the following Key Performance Indicators (KPIs) were used:

- number and proportion of children less than 5 years of age who are underweight;
- number and proportion of Indigenous clients with type 2 diabetes and whose HbA1c[7] measurements are within certain levels;
- number and proportion of Indigenous clients who have type 2 diabetes and who have good blood pressure control within a six month period; and
- proportion of regular clients aged 31 and over at risk of CKD.

Each of these KPIs relates to a number of services provided by DDHS, including chronic disease management plans, health checks, and maternal and childhood health services, allowing estimation of the impact of DDHS services on type 2 diabetes, CKD, and maternal and childhood health.

3.1.2 Estimating overall health status among DDHS clients

As this analysis was limited to three areas of DDHS services, care has been taken to ensure that the areas selected represent a reasonable estimate of the incremental impact on health outcomes (including positive and negative impacts) from DDHS services. While the NT does collect data on a number of other KPIs beyond the three that were chosen for this analysis, **the three KPIs selected capture a substantial proportion of the burden of disease[8] in Indigenous people in the NT that can be observed through the AHKPI Information System.**

The 2003 *Burden of disease and injury in Aboriginal and Torres Strait Islander peoples* study (Vos et al, 2007) was used to determine the total burden of disease attributable to various conditions. The study indicates that:

- diabetes and cardiovascular disease account for 26% of the burden of disease in Indigenous people in Australia – **these areas are captured in the cost-benefit analysis**;
- communicable diseases, and maternal and neonatal conditions collectively represents 12% of the burden of disease in Indigenous people in Australia, and 32% of the burden of disease in Australian Indigenous children aged 0-14 – **childhood health outcomes are captured in the cost-benefit analysis**;[9]

[7] Glycated haemoglobin

[8] Burden of disease is a wellbeing measure, which measures pain, suffering and premature mortality in terms of DALYs. Further information is provided in Section 2.1.1.

[9] Underweight is a risk factor that contributes to a number of communicable diseases, maternal and neonatal conditions (Fishman et al, 2004).

- mental disorders, cancers, injuries, chronic respiratory, genitourinary, musculoskeletal, skin, oral, nervous system and endocrine and metabolic conditions collectively represent 59% of the burden among Indigenous people in Australia – **however, no AHKPIs are available for these conditions**; and
- congenital anomalies represent the remaining 3% of the burden – **however, no AHKPIs are available for these conditions**[10].

Thus, the available data limit the health conditions which can be assessed for this analysis.

The AHKPI data also capture health status as it relates to smoking, immunisations, anaemia and acute rheumatic fever (ARF) or rheumatic heart disease (RHD). In regards to smoking, no significant difference in smoking rates was reported compared to non-DDHS clients, which would mean that quantification in this area would not impact on the cost-benefit analysis. For immunisations, a significance difference was reported in the number of children immunised and the timeliness of immunisations; however, no data were collected in the AHKPI Information System that could attribute these immunisations to conditions and associated health outcomes, so this KPI could not be quantified.

There are two KPIs where DDHS results are significantly different to non-DDHS results, but are not quantified since the impacts are relatively small and the impacts work in different directions. The two KPIS are the prevalence of anaemia in children and those with a diagnosis of ARF or RHD who are prescribed medication to prevent reoccurrence. Both of these KPIs would likely alter the benefits; however, both of these areas represent a clinically significant but small proportion of the burden of disease among Indigenous people, and thus would not be expected to contribute significantly to the incremental health improvements achieved by DDHS services.

First, the prevalence of anaemia is higher among children who use DDHS services, which indicates that DDHS services deliver an incremental negative benefit. However, iron deficiency accounts for a small amount of the burden of disease – approximately 0.6% for children in Australia (Begg et al, 2007) – and so it was considered that quantifying this aspect would have a small impact on the overall health benefits of DDHS services.

Second, the number of people with a diagnosis of ARF or RHD who are prescribed medication to prevent reoccurrence is lower among DDHS clients. This represents additional benefits which could be attributed to DDHS, although the impact of ARF/RHD is small in Australia – approximately 1% of the burden in Indigenous people. However, counteracting the positive benefits is the finding that DDHS clients do not take the prescribed medication as often as non-DDHS clients, which would increase the chance of reoccurrence, and be attributed to DDHS as a negative benefit.

[10] Health care visits by mothers during pregnancy is reported in the AHKPI Information System. More timely visits during pregnancy can lead to better outcomes, such as improved birth weight in children. It is likely that some of the burden due to congenital anomalies – where burden due to the condition primarily occurs in children – could be avoided by increasing ante-natal care attendance during pregnancy. However, DDHS performs at comparable levels to the rest of the NT for birth weight of children – with no significant differences in health status – and so additional quantification in this area would not have had an impact on the cost-benefit analysis.

It is important to note that the AHKPIs are being revised and added to regularly. When more data is available, it is expected that quantification of wellbeing and/or financial benefits (both positive and/or negative) – in additional areas such as sexually transmissible diseases, cardiovascular risk (separate from type 2 diabetes and CKD), and screening for diabetic retinopathy – will be possible (NT AHKPI Clinical Reference Group, 2015).

3.1.3 Health gap

Indigenous Australians living in rural and remote areas typically have worse health than those in in urban areas (such as Alice Springs or Darwin, in the NT). In addition to worse access to health care in rural and remote areas, this difference in health is also due to a large number of behavioural and socioeconomic factors, which are outside of DDHS' control. Therefore, when comparing health between DDHS clients (the overwhelming majority of whom reside in urban areas in Greater Darwin) and non-DDHS clients, some of whom live in rural and remote areas, it is important to control for the fact that location of residence will impact on health.

Zhao et al (2013) provide a measure of the health gap in different areas of the NT using DALYs. By comparing the rate of DALYs per 1,000 population, it is possible to gain an overall estimate of the health status of DDHS clients, compared to non-DDHS clients. The average DALYs per 1,000 population for the Darwin regions is 421, compared with 555 in the remaining NT regions. **This means that, per person, Indigenous Darwin residents experience approximately 76% of the burden of disease and disability, compared to Indigenous residents in the rest of the NT**. That is, Indigenous Darwin residents are healthier than their counterparts who don't live in Darwin.

It is conceivable that a small proportion of the better health among Darwin residents is attributable to DDHS services (as DDHS has been providing services for a number of years) – health status is affected by a number of factors, such as socioeconomic and behavioural factors, as well as access to health care. However, primary health care is only one component of all health care received by patients, and the other socioeconomic and behavioural factors have been suggested to cause the majority of the health gap between Indigenous and non-Indigenous Australians, as reported by the Australian Institute of Health and Welfare (AIHW, 2014a). Thus, it is considered likely that this also explains the majority of the difference between Indigenous Australians living in rural and remote areas of the NT when compared to Indigenous residents of Greater Darwin.

> As access to primary health care is only one determinant of overall health status, and there are numerous other primary and non-primary health care services that DDHS clients would utilise, this cost-benefit analysis assumes that DDHS would, alone, not have caused the difference in health status between Greater Darwin and the rest of the NT. Thus, the benefits which are calculated to arise as a result of DDHS services are multiplied by 0.76, to remove any impact that living in Greater Darwin has had on DDHS clients' overall health[11].

[11] This also has the effect of presenting a conservative estimate of the benefits of DDHS services. If we relax the assumption that DDHS has not had a significant impact on health status among Greater Darwin residents, then

The following sections outline the methodologies and data for calculating the incremental benefits in the areas of maternal and childhood health, blood glucose and blood pressure management, and CKD management.

3.2 Maternal and childhood health services

There are a number of benefits of maternal and childhood health services. In particular, these services can lead to improved health for children relating to weight and nutritional outcomes.

The NT AHKPI system collects and reports information on the number of children less than five years of age and who are less than two standard deviations away from the mean weight for their age (this is defined in the medical literature as "underweight"). Below average weight is a sensitive indicator of the nutritional status of children and their subsequent health outcomes (NT AHKPI Clinical Reference Group, 2015).

The proportion of children who are underweight among DDHS and non-DDHS clients are shown in Table 3.1. The DDHS clients have a lower proportion of children who are classified as underweight according to this measure, with 3.2% compared to the non-DDHS average of 4.5%.

Table 3.1: Proportion of children who are underweight among DDHS and non-DDHS clients, 2014-15

	DDHS	Non-DDHS
Total number of children	783	6104
Total number of children measured	532	5588
Number of children who are underweight	17	251
Proportion of children who are underweight	3.2%	4.5%

Source: NT AHKPI Information System (2015).

Applying the 1.3% difference in the proportion of children who are underweight to the total number of children who are DDHS clients (783) means that there are 10 avoided cases of underweight children among DDHS clients in 2015-16. Further adjusting this by the health gap proportion (see section 3.1.3), 8 of these are attributed to DDHS services.

To determine the burden of disease avoided that would have occurred for these eight children, it is necessary to estimate the burden of disease associated with being two standard deviations below mean weight for age.

The World Health Organization publication *Comparative quantification of health risks*, analyses the burden of disease, disability and death that arises from 26 risks to human

the calculated benefits would be multiplied by a number larger than 0.76, and the benefit attributed to DDHS would be greater.

health. The analysis provides attributable fractions[12] for children who are more than two standard deviations from the mean weight of children (Fishman et al, 2004). The attributable fractions are reported for diarrhoeal diseases, lower respiratory infections, malaria, measles, protein-energy malnutrition and all other communicable, maternal, perinatal and nutritional conditions excluding human immunodeficiency virus infection/acquired immune deficiency syndrome (HIV/AIDs) and those mentioned already. Table 3.2 summarises the attributable fractions for each condition by gender.

Table 3.2: Attributable fractions for selected conditions among underweight children, Australia

Condition	Male (%)	Female (%)
Diarrhoeal diseases	1.49	0.80
Low birth weight	0.54	0.45
Lower respiratory infections	7.37	7.34
Malaria	0.46	0.46
Measles	5.54	5.52
Protein-energy malnutrition	100.00	100.00
Other communicable, maternal, perinatal and nutritional conditions (excl. HIV/AIDS)	2.00	1.56

Source: Fishman et al (2004).

Vos et al (2007) published the burden of disease in Indigenous Australians in 2003 for the age group 0-14 years. The DALYs estimated are shown in Table 3.3, albeit with somewhat different condition categories from those reported by Fishman et al (2004).

Table 3.3: DALYs for selected conditions associated with an Indigenous child (aged 0-14 years) being underweight, Australia

Condition	Male	Female	Person
Tuberculosis	1	1	2
Sexually transmitted diseases	3	41	44
Hepatitis	3	15	18
Other infectious and parasitic diseases (excl. HIV/AIDS)	348	334	682
Lower respiratory infections	248	224	472
Maternal conditions	0	1	1
Nutritional deficiencies	186	221	407
Total	**789**	**837**	**1,626**

Source: Vos et al (2007).

As the DALYs reported in Vos et al (2007) are for Indigenous Australians in 2003, they were adjusted to determine the burden of disease in NT children for the year 2015-16. This required adjustment:

[12] Attributable fractions are a measure of the contribution of various risk factors to the burden of a specific disease or condition, and are estimated using prevalence and risk estimates for each disease or condition (Fishman et al, 2004).

- to the age group from 0-14 years to 0-4 years; and
- from total DALYs in Australia to DALYs in the NT.

To adjust the age group to Indigenous children aged 0-4 years, the DALYs are adjusted using the ratio of age 0-4 to age 0-14 for the same set of conditions using data for all Australians reported by Begg et al (2007). To adjust the DALYs to be specific to the NT, the total DALYs for children aged 0-4 years were multiplied by the proportion of Indigenous children aged 0-4 living in the NT compared to all Indigenous children aged 0-4 in Australia using data from the Australian Bureau of Statistics (ABS, 2014). Finally, the DALYs in NT Indigenous children were adjusted to 2015-16 using population growth for the NT over the period 2002-03 to 2015-16 (ABS, 2014). Table 3.4 shows the resulting burden of disease for selected conditions in Indigenous children aged 0-4 in the NT.

Table 3.4: DALYs for selected conditions associated with an Indigenous child (aged 0-4 years) being underweight, NT

Condition	Male	Female	Person
Tuberculosis	0	0	0
Sexually transmitted diseases	0	3	3
Hepatitis	0	1	1
Other infectious and parasitic diseases (excl. HIV/AIDS)	26	25	51
Lower respiratory infections	17	14	32
Maternal conditions	0	0	0
Nutritional deficiencies	15	18	33
Total	**59**	**61**	**120**

Source: Vos et al (2007), Begg et al (2007), ABS (2014) and Deloitte Access Economics calculations.

The attributable fractions for each condition are shown in Table 3.5, with the estimated burden of disease attributable to each underweight child in the NT in 2015-16 in Table 3.6.

The attributable fractions for other infectious and parasitic diseases (excluding HIV/AIDS) is the average of the attributable fractions (from Table 3.2) relating to diarrhoeal diseases, malaria, measles and other communicable, maternal, perinatal and nutritional conditions, as all of these conditions fall under this broad level category. The attributable fractions for tuberculosis, sexually transmitted diseases, hepatitis and maternal conditions are taken from other communicable, maternal and nutritional conditions – the broad level category for these conditions. 'Nutritional deficiencies' adopts the attributable fraction for protein-energy malnutrition.

Multiplying the DALYs per Indigenous child in the NT aged 0-4 due to being underweight by the number of avoided cases of a child being underweight[13], gives the expected total avoided DALYs due to DDHS services in 2015-16, as shown in Table 3.7.

[13] In fact, 7.706 rather than 8, as 'rounded up' in the text earlier.

Table 3.5: Attributable fractions for selected conditions among Indigenous underweight children (aged 0-4 years), NT

Condition	Male (%)	Female (%)
Tuberculosis	2.00	1.56
Sexually transmitted diseases	2.00	1.56
Hepatitis	2.00	1.56
Other infectious and parasitic diseases (excl. HIV/AIDS)	2.37	2.08
Lower respiratory infections	7.37	7.34
Maternal conditions	2.00	1.56
Nutritional deficiencies	100.00	100.00

Source: Fishman et al (2004).

Table 3.6: DALYs per underweight Indigenous child (aged 0-4 years), NT

Condition	Male	Female	Person
Tuberculosis	0.000003	0.000002	0.000005
Sexually transmitted diseases	0.000016	0.000122	0.000138
Hepatitis	0.000012	0.000060	0.000072
Other infectious and parasitic diseases (excl. HIV/AIDS)	0.001842	0.001566	0.003408
Lower respiratory infections	0.003840	0.003154	0.006994
Maternal conditions	0.000000	0.000000	0.000000
Nutritional deficiencies	0.044476	0.052835	0.097311
Total	**0.050189**	**0.057739**	**0.107928**

Source: Fishman et al (2004), Vos et al (2007), Begg et al (2007), ABS (2014) and Deloitte Access Economics calculations.

Table 3.7: DALYs avoided due to DDHS services, 2015-16

Condition	Male	Female	Person
Tuberculosis	0.000	0.000	0.000
Sexually transmitted diseases	0.000	0.001	0.001
Hepatitis	0.000	0.000	0.001
Other infectious and parasitic diseases (excl. HIV/AIDS)	0.014	0.012	0.026
Lower respiratory infections	0.030	0.024	0.054
Maternal conditions	0.000	0.000	0.000
Nutritional deficiencies	0.343	0.407	0.750
Total	**0.387**	**0.445**	**0.832**

Source: Fishman et al (2004), Vos et al (2007), Begg et al (2007), ABS (2014) and Deloitte Access Economics calculations.

Overall, it is expected that DDHS services will prevent 8 cases of underweight children in 2015-16, saving 0.83 DALYs. The corresponding value of life saved is expected to be $159,940 in 2015-16 dollars.

There would also be health system and other financial costs associated with children being underweight. A literature search was conducted to determine the health system and other financial costs, although no relevant data were identified.

It is important to note that the result for the proportion of DDHS clients who are underweight compared to the rest of the NT was not significant at the 5% level; however it was significant at 10%[14]. This means that the benefits quantified for maternal and childhood health services should be used with some caution. Data from additional years may help identify any trends in significance over time.

3.3 Chronic disease management for type 2 diabetes

DDHS provides a number of health services that improve health outcomes for people with type 2 diabetes and other chronic diseases. Improved blood glucose and blood pressure management has been linked to improved health outcomes in people with type 2 diabetes. AHKPI data show that DDHS clients have better control of their blood glucose and blood pressure than non-DDHS clients. The following sections quantify the benefits of this improved management.

3.3.1 Blood glucose management

HbA1c is an index of the average blood glucose level for a person over the previous 2-3 months, and can be used to monitor blood glucose management in people with diabetes. **High blood glucose levels can place a person at risk of developing complications including vision loss, neuropathy, renal disease and cardiovascular complications.** Long term follow-up studies have shown a significant reduction in diabetes-related complications with intensive blood glucose management (NT AHKPI Clinical Reference Group, 2015).

Table 3.8 presents the number of DDHS and non-DDHS clients who have type 2 diabetes and whose HbA1c measurements fall within a reported range as shown. The target HbA1c measurement for people with type 2 diabetes is less than 7%.

Table 3.8: Blood glucose management among DDHS and non-DDHS clients, 2014-15

HbA1c	DDHS	Non-DDHS
<=7%	240	1,836
>7% and <=8%	146	1,000
>8% and <10%	125	1,217
>=10%	111	1,604
Average HbA1c	7.95%	8.35%

Source: NT AHKPI Information System (2015).

[14] Keller and Warrack (2003) note that statistical significance at the 5% level provides strong evidence, while statistical significance at the 10% level provides weak evidence.

On average, HbA1c is 0.4% better for DDHS clients than for non-DDHS clients – a relative improvement of 4.8%. **This means that the risk of developing diabetes-related complications is lower for DDHS clients with diabetes, compared to non-DDHS clients who have diabetes.** As with other benefits from DDHS services, the benefit of reduced HbA1c is adjusted by 76% to account for Indigenous people in Greater Darwin being generally healthier than the rest of the NT.

To establish the benefits of DDHS services, it is necessary to establish the prevalence of diabetes-related complications among people with diabetes, and the reduction in the prevalence of complications as a result of improved management of blood glucose levels.

3.3.1.1 Prevalence of diabetes-related complications

Maple-Brown et al (2007) established the prevalence of diabetes-related complications such as retinopathy and neuropathy among the adult Indigenous population of Darwin who had diabetes. The estimated prevalence was 21% for retinopathy, and 9% for neuropathy. This drew on results from the Darwin Region Urban Indigenous Diabetes Study of 1,004 volunteers aged 15 years and over.

The prevalence of CKD in Indigenous people with diabetes was estimated to be approximately 14.0%, based on results from the Aboriginal and Torres Strait Islander Health Survey (ABS, 2014a) and the AIHW (2011). The prevalence of other complications of diabetes such as lower limb amputations (0.6%), coronary heart disease (10%), myocardial infarction (5%) and stroke (5%) were assumed to be the same as for the general population, as published by the AIHW (2008), noting that this is likely to be conservative for the NT Indigenous population.

3.3.1.2 Reduced prevalence of complications due to improved management of blood glucose levels

Complications of diabetes include retinopathy, nephropathy, neuropathy, coronary heart disease, myocardial infarction and stroke (Fowler, 2008). Complications of diabetes are broadly grouped into microvascular conditions (retinopathy, nephropathy and neuropathy) and macrovascular complications (coronary heart disease, myocardial infarction and stroke). There are a number of major studies on the risk of complications in people with type 2 diabetes. For example:

- A study by the United Kingdom Prospective Diabetes Study (UKPDS) Group found that a 0.9% point reduction in HbA1c levels across a population results in a 25% reduction in the incidence of microvascular complications such as retinopathy, neuropathy and nephropathy. There was also a 16% reduction in myocardial infarction (UKPDS Group, 1998).
- The Action to Control Cardiovascular Risk in Diabetes (ACCORD) study found that a reduction of 1.1% point in HbA1c levels across the study population resulted in a 24% reduction in myocardial infarction (ACCORD Study Group, 2008).
- The Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE) trial found that a 0.8% point reduction in HbA1c levels resulted in a 10% reduction in the incidence of microvascular and macrovascular complications (ADVANCE Collaborative Group, 2008).

Table 3.9 summarises these studies that have observed long-term outcomes in people with type 2 diabetes for diabetes-related complications.

Table 3.9: Summary of comorbidity and the impact of HbA1c reductions

Study (year)	Brief description	Main findings
UKPDS Group (1998)	Longitudinal study to assess the impacts of improved blood glucose management on mortality and the risk of microvascular and macrovascular complications of diabetes.	0.9% absolute reduction in HbA1c levels from 7.9% to 7% across a population results in a 25% reduction in the incidence of microvascular complications such as retinopathy, neuropathy and nephropathy, and a 16% reduction in in the incidence of myocardial infractions (a macrovascular complication).
ACCORD Study Group (2008)	Trial investigating whether intensive therapy to improve blood glucose management would reduce cardiovascular events in people with type 2 diabetes.	1.1% absolute reduction in HbA1c levels from 7.5% to 6.4% results in a 24% reduced chance of myocardial infarction (a macrovascular complication).
ADVANCE Collaborative Group (2008)	Trial involving either intensive glucose management or intensive glucose management to assess primary end point of either macrovascular and microvascular events.	0.8% absolute reduction in HbA1c levels from 7.3% to 6.5% results in a 10% reduction in the incidence of microvascular and macrovascular complications.
Average[15]	**Reduction in microvascular end-points of 17.5% for the HbA1c reduction of 0.85%, and a reduction in macrovascular end-points of 15% for HbA1c reduction of 0.9%.**	

Based on the findings of the UKPDS, ACCORD and ADVANCE diabetes studies, the average reductions in microvascular and macrovascular endpoints were 17.5% and 15%, respectively. As these reductions are based on HbA1c reductions of approximately 0.85% and 0.9% respectively, they are multiplied by the average HbA1c reduction of 0.4%, resulting in a **reduction in microvascular and macrovascular endpoints of 8.2% and 6.6%**[16], respectively.

[15] The average reduction in microvascular end-points, and the average change in HbA1c for this reduction, is calculated by taking the average of microvascular complications in the UKPDS and ADVANCE studies (average of 10% and 25% for reduction in microvascular end-points and 0.8% and 0.9% absolute HbA1c reduction). The average reduction in macrovascular end-points is calculated by taking the average of the myocardial infarction reduction reported in the ACCORD and UKPDS studies (24% and 16%, respectively) and then taking the average of the result (20%) and the ADVANCE study (10%). This approach is used in order to give less weighting to myocardial infarction (as it is only one macrovascular complication), and more weighting to the ADVANCE results which are for all macrovascular complications. The associated HbA1c reduction is calculated in the same way – by taking the average of 1.1% and 0.9%, and then taking the average of the result (1.0%) and the ADVANCE study (0.8%).

[16] 8.2% = 0.4% / 0.85% * 17.5%, and 6.6% = 0.4% / 0.9% * 15%.

3.3.1.3 Calculating the value of reduced prevalence of diabetes-related complications

To calculate the economic value of reduced prevalence of diabetes-related complications, the **average reductions in the prevalence of complications** from the UKPDS, ACCORD and ADVANCE studies are applied against the number of DDHS clients with diabetes. The prevalence of complications and the associated reduction in these complications from improved HbA1c management are summarised in Table 3.10. The cases averted were then multiplied by:

- the cost of an episode of care for each condition, to estimate the health cost savings in 2015-16; and
- the burden of disease associated with each condition, to estimate the burden of disease savings in 2015-16.

Health costs averted

To quantify the value of health costs averted, the health system costs per person for CKD, neuropathy, amputations and myocardial infarction were calculated using the Independent Hospital Pricing Authority (IHPA) cost weights associated with each condition (IHPA, 2015):

- CKD was calculated as the weighted average of health system costs for Australian refined diagnostic related group (AR-DRG) codes L60A, L60B and L60C;
- neuropathy was assigned a weighted average of health system costs related to AR-DRG codes B06A and B06B;
- amputations were assigned a weighted average of health system costs related to the AR-DRG codes F13A and F13B; and
- myocardial infarction was assigned a weighted average of health system costs related to AR-DRG codes F62A and F62B.

Health system costs for vision loss, coronary heart disease and stroke were sourced from Deloitte Access Economics (2013), which quantified the health costs associated with each condition based on Australian data. All costs were updated to 2015-16 dollars using the health component of the consumer price index (CPI) (ABS, 2015). The expected health system costs per person are reported in Table 3.10.

Table 3.10: Costs of secondary complications averted due to DDHS, 2015-16

Complication	Prevalence amongst people with diabetes (A)	Reduction from glycaemic control (B)	Expected reduction in prevalence (C = B * A * prevalence)	Health system costs per person per annum, $ (D)	Expected savings, $ (E = C * D)
Visual loss (including retinopathy)	21.0%	8.2%	12.0	5,574*	66,963
CKD	14.0%	8.2%	8.0	9,835	78,768
Neuropathy	9.0%	8.2%	5.1	9,448	48,644
Amputations	0.6%	8.2%	0.3	12,272	4,212
Coronary heart disease	10.0%	6.6%	4.6	29,861*	138,290
Myocardial Infarction	5.0%	6.6%	2.3	8,958	20,742
Stroke	5.0%	6.6%	2.3	2,444*	5,660
Total			**34.8**		**363,279**

Source: IHPA (2015), UKPDS Group (1998), ADVANCE Collaborative Group (2008), ACCORD Study Group (2008), AIHW (2008). * indicates total health system costs from Deloitte Access Economics, 2013.

As of June 2015, there were 920 regular DDHS clients with diabetes, which led to an estimated reduction in secondary complications of 34.8 cases over the year as shown in Table 3.10. **The total reduction in health system costs due to improved blood glucose management of DDHS clients with diabetes was estimated to be $363,279 in 2015-16**.

Burden of disease costs averted

Wellbeing savings associated with a reduction in complications of diabetes contribute substantial benefits to society overall. To determine the wellbeing savings, the estimated reduction in prevalence of complications were multiplied by the disability weights associated with each complication.

Disability weights for retinopathy, neuropathy and CKD were obtained from the Australian burden of disease studies (Begg et al, 2007; Mathers et al, 1999) who based their estimates on results from the Dutch study undertaken by Stouthard et al (1997):

- retinopathy (0.067) was calculated as a weighted average across mild, moderate and severe vision loss from the Dutch study (consistent with the approach in Begg et al, 2007), as retinopathy is a disease that results in vision loss and is typically treated before it leads to more serious vision loss;
- neuropathy (0.19) was adopted from the Dutch study;
- CKD (0.29) used the Dutch weight for diabetic nephropathy, which refers to damage to the kidney;

- amputations (0.113) was adopted from the global burden of disease study as there was no Dutch weight for amputation and diabetic foot;
- myocardial infarction (0.395) was modelled using the average Dutch weight for acute myocardial infarction reported in Mathers et al (1999);
- coronary heart disease (0.309) was adopted from the average Dutch weight for ischaemic heart disease reported in Mathers et al (1999); and
- stroke (0.438) was calculated as the average Dutch weight for mild, moderate and severe stroke as reported in Mathers et al (1999) – weighted using outcomes from an outcomes study for stroke survivors (Kelly-Hayes et al, 2003).

The parameters and expected change in prevalence, and the associated healthy life saved are shown in Table 3.11. The healthy life saved, in terms of reduced morbidity, is multiplied by the VSLY to get the value of healthy life saved in 2015-16.

Table 3.11: Wellbeing savings from secondary complications averted due to DDHS, 2015-16

Complication	Change in prevalence from glycaemic management	Disability weight	YLDs saved	Value of life saved
Visual loss (incl. retinopathy)	12.0	0.067	0.8	155,399
CKD	8.0	0.290	2.3	446,648
Neuropathy	5.1	0.190	1.0	188,120
Amputations	0.3	0.113	0.0	7,459
Coronary heart disease	4.6	0.309	1.4	275,187
Myocardial Infarction	2.3	0.395	0.9	175,888
Stroke	2.3	0.438	1.0	195,035
Total	**34.8**		**7.5**	**1,443,736**

Source: IHPA (2015), UKPDS Group (1998), ADVANCE Collaborative Group (2008), ACCORD Study Group (2008), AIHW (2008).

Total wellbeing savings associated with a reduction in diabetes-related complications are expected to contribute savings of approximately $1.44 million to society in 2015-16.

Total economic costs averted

Overall, the economic benefits of improved HbA1c management are expected to be $1.81 million in 2015-16 – comprised of $0.36 million in avoided health system costs and $1.44 million in reduced burden of disease[17].

[17] Note: numbers do not add due to rounding.

3.3.2 Blood pressure management

For people with type 2 diabetes, managing high blood pressure can help to reduce the risk of complications associated with having type 2 diabetes. Those with good blood pressure are more likely to have reduced incidence of cardiovascular disease and it helps to delay progression of renal disease (NT AHKPI Clinical Reference Group, 2015).

The use of angiotension converting enzyme inhibitor (ACE) and/or angiotension receptor blocker (ARB) have been demonstrated to significantly improve blood pressure management and reduce renal deterioration (NT AHKPI Clinical Reference Group, 2015). Data from the NT AHKPI Information System (2015) shows that regular clients of DDHS who have type 2 diabetes and require blood pressure management have higher use of ACE and/or ARB treatments – 89% compared with 84% in the rest of the NT.

This increase in the proportion of people meeting the indicator has likely led to a higher proportion of Indigenous clients with good blood pressure management – defined as less than or equal to 130/80 mm Hg[18]. Table 3.12 shows the number of DDHS clients with type 2 diabetes who meet the target for blood pressure (53.7%), compared to non-DDHS clients (49.1%).

Table 3.12: Blood pressure management in DDHS and non-DDHS clients with type 2 diabetes, 2014-15

	DDHS	Non-DDHS
Number of clients with diabetes	920	6,691
Proportion with blood pressure <= 130/80 mm Hg	53.7%	49.1%

Source: NT AHKPI Information System (2015).

The steps that are needed to quantify this benefit in terms of burden of disease and health system costs averted are similar to the steps taken for blood glucose management in section 3.3.1.

3.3.2.1 Reduced prevalence of complications due to improved blood pressure management

To determine the benefits of improved blood pressure management, the academic literature was searched to establish the benefits of meeting the target of <= 130/80 mm Hg.

Hansson et al (1998) studied the effects of blood pressure targets on outcomes for patients with diabetes. With intensive blood pressure targets (<=80 mm Hg for diastolic blood pressure), the risk of cardiovascular events was halved compared to those with less intensive targets of <= 85 mm Hg and <= 90 mm Hg. The risk of myocardial infarction was also approximately half that of the less intensive group. The risk reduction of stroke was approximately 30%. There was also reduced risk of cardiovascular mortality.

[18] Blood pressure is reported as the ratio of systolic on diastolic blood pressure, which is the pressure as the heart pumps blood during each beat (systolic) compared to the pressure as the heart relaxes before the next beat (diastolic). The ratio is reported in terms of millimetres of mercury (mm Hg).

Table 3.13: Number of events per 1,000 patient years by blood pressure level

Complication	<=80 mm Hg	<=85 mm Hg	<=90 mm Hg	Average of <= 85-90 mm Hg	Absolute change
No. of events per 1,000 patient years					
Myocardial infarction	3.7	4.3	7.5	5.9	2.2
Stroke	6.4	7	9.1	8.1	1.7
Cardiovascular mortality	3.7	11.2	11.1	11.2	7.5

Source: Hansson et al (1998).

The reductions in relative risk presented in Hansson et al (1998) are calculated relative to the average of the higher blood pressure ranges of <= 85 mm Hg and <= 90 mm Hg. It is important to note that blood pressure of > 90 mm Hg exists in some people, and that it is reasonable to assume that reducing blood pressure in these people to <= 80 mm Hg would bring with it an even larger reduction in relative risk. However, no studies were identified that estimated this reduction in relative risk.

DDHS clients who meet the blood pressure targets are expected to have 2.2 fewer myocardial infarction events, 1.7 fewer stroke events, and 7.5 fewer deaths due to cardiovascular conditions per 1,000 patients, compared to if these clients had not reached the targeted blood pressure range.

As there are an additional 4.6% of clients with type 2 diabetes who meet the target blood pressure of <=130/80 mm Hg, this translates to 43 clients (920 * 4.6%), or 43 patient years over the 2016 financial year. Of the 43 patients, 36 are assumed to be attributable to DDHS services after adjusting for the health gap reported by Zhao et al (2013). **There are therefore expected to be 0.08 fewer myocardial infarctions (2.2 / 1000 * 36), 0.06 fewer strokes (1.7 / 1000 * 36) and 0.27 fewer cardiovascular deaths (7.5 / 1000 * 36) in 2015-16 among DDHS clients, as a result of the health care delivered by DDHS.**

3.3.2.2 Calculating the value of reduced prevalence of diabetes-related complications

The reduction in myocardial infarctions, cases of stroke and cardiovascular deaths results in burden of disease and health system cost savings. The calculations and parameters for these are outlined below.

Burden of disease costs averted

The majority of savings are due to the prevention of loss of life due to cardiovascular disease. The average age of an Indigenous person with type 2 diabetes is approximately 52 (ABS, 2014a), and there are expected to be 23 years of life remaining at this age (ABS, 2013). Assuming that the average death due to cardiovascular events is at this age, then

there is 17 years of life remaining in NPV terms (discounted at 3%[19]), saving 4.11 years of life in 2015-16 (17 years of life remaining * 0.27 events).

Multiplying the change in events by the VSLY, the incremental benefits of improved blood pressure management was valued at $0.89 million in 2015-16. The change in the expected number of events, and the value of life saved, are outlined in Table 3.14.

Health system costs averted

The change in expected myocardial infarction and stroke events also results in reduced health system costs. As reported in section 3.3.1, the cost of a case of myocardial infarction and stroke are $8,958 and $2,444, respectively. Multiplying these values by the change in expected number of events gives expected health system savings of $1,981 due to DDHS services.

Total economic costs averted

Table 3.14 presents the incremental benefits of improved blood pressure management due to DDHS services.

Table 3.14: Incremental benefits of improved blood pressure management

Complication	Change in expected no. of events	Disability weight	Saved YLD	Saved YLL	Health system savings ($)	Value of life saved ($)	Total savings ($)
Myocardial infarction	0.08	0.395	0.031	-	1,645	6,023	7,667
Stroke	0.06	0.438	0.026	-	337	5,009	5,345
Cardiovascular mortality	0.27	-	-	4.57	N/A*	878,349	878,349
Total					**1,981**	**889,381**	**891,362**

Source: Hansson et al (1998), Mathers et al (1999), Begg et al (2007).
Note: * as health system costs primarily relate to treating ongoing conditions, the costs associated with fatalities would likely be minimal, and as such have not been quantified.

In estimating the benefits of blood pressure management on reducing the complications of type 2 diabetes, it is important that the calculations do not double-count any of the benefits which were calculated in the blood glucose calculations in Section 3.3.1. Zoungas et al (2009) report on results from the ADVANCE trial, where the effects of routine blood pressure lowering and intensive glucose control were assessed on clinical outcomes. Zoungas et al (2009) observed that there was no interaction between intensive blood pressure management and intensive blood glucose management. **Consequently, it is assumed that the benefits reported in section 3.3.1 are in addition to those from improved blood pressure management.**

[19] Life is discounted to account for the uncertainty of the future – recognising that a year of life now is valued more than a year of life in the future as an individual does not know if they will be alive at a future time. The discount rate of 3% is a standard assumption for discounting years of life (for example, Begg et al, 2007).

Overall, the economic benefits of improved blood pressure management are expected to be $0.89 million in 2015-16 – comprised of $0.002 million in avoided health system costs and $0.89 million in reduced burden of disease.

3.4 Risk of CKD

DDHS delivers health care which reduces the risk of CKD risk among its clients who are screened for renal disease, compared to non-DDHS clients who are screened for renal disease.

Early detection and appropriate treatment of renal disease slows down the progression of renal disease and delays the need for dialysis (NT AHKPI Clinical Reference Group, 2015). Data collected through the AHKPI records the number and proportion of clients aged 31 years and over who have been screened for renal disease according to Central Australian Rural Practitioners Association guidelines during a two year period. It also shows the proportion of those screened who have screening results suggestive of CKD.

To determine the benefits of DDHS services in this area, it is necessary to know how many cases of CKD may be prevented by DDHS services, and the associated reduction in complications, which reduce health expenditure and burden of disease. The first is estimated using NT KPI data for renal assessment by level of risk, and the latter is estimated through literature.

3.4.1 Prevalence of CKD

Table 3.16 shows the proportion of DDHS clients with risk of renal disease, compared to non-DDHS clients. DDHS clients are less likely to have higher risk levels of renal disease compared to non-DDHS clients – 23% of non-DDHS clients are at moderate to severe risk, compared to 17% among DDHS clients.

The NT AHKPI classifies people into risk categories of CKD based on their estimated glomerular filtration rate (eGFR) and their serum albumin/creatinine ratio (ACR) as shown in Table 3.15.[20]

[20] eGFR is a measure used to estimate how much blood passes through filters (glomeruli) in the kidney. ACR is a measure of how much albumin is present in the blood relative to the creatinine in the urine. Creatinine is released into the urine at a consistent rate, and indicates the urine concentration. Albumin is not present when kidneys are functioning properly, so the ACR test can provide an indication of poor kidney function.

Table 3.15: Classification of risk of CKD by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	Normal	Mild	Moderate	Severe
45-60	Mild	Moderate	High	Severe
15-45	High	High	High	Severe
<15	Severe	Severe	Severe	Severe

Source: NT AHKPI Information System (2015).

Based on these classifications, the risk of CKD among DDHS and non-DDHS clients is shown in Table 3.16.

Table 3.16: Outcome of renal assessments among DDHS and non-DDHs clients, 2014-15

Level of risk	DDHS	Non-DDHS
Severe risk	3%	5%
High risk	3%	4%
Moderate risk	11%	14%
Mild risk	24%	28%
Normal risk	60%	49%
Number of complete client assessments	1,463	12,738

Source: NT AHKPI Information System (2015).

The estimated proportion of DDHS and non-DDHS clients in each category is shown in Table 3.17. Where there is more than one risk category, the proportion of people in each risk category is allocated evenly across the applicable risk categories. To illustrate this idea, consider the severe risk categories from Table 3.15. There are 7 severe risk categories, and Table 3.16 specifies that 3% of DDHS clients are in the severe risk category. Thus, to apportion the 3% of clients into the 7 severe risk categories, 0.4% (=3%/7) are allocated into each severe risk category, as shown in Table 3.17. This is done for both the DDHS and non-DDHS clients, for each of the risk categories.

Table 3.17: Proportion of clients by eGFR and ACR

	DDHS (%)				Non-DDHS (%)			
eGFR (mL/min/1.73m^2)	ACR (mg/mmol)				ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*	*<3*	*3-30*	*30-300*	*>=300*
>60	59.7	11.8	5.3	0.4	49.9	13.9	6.7	0.7
45-60	11.8	5.3	0.8	0.4	13.9	6.7	1.0	0.7
15-45	0.8	0.8	0.8	0.4	1.0	1.0	1.0	0.7
<15	0.4	0.4	0.4	0.4	0.7	0.7	0.7	0.7

Source: NT AHKPI Information System (2015).

3.4.1.1 Adjustment from screening test to confirmation of CKD

It is important to note that the lower risk of CKD among DDHS clients does not directly correspond to a diagnosis of CKD. Diagnosis requires two tests at least three months apart that both indicate impaired kidney functioning, as recommended by Kidney Disease Improving Global Outcomes (KDIGO, 2013). Impaired kidney functioning is defined as eGFR of <60 ml/min/1.73m^2, or markers of kidney damage (ACR > 3 mg/mmol), where the duration is more than 3 or more months. An abnormal result in one test may be due to short-term fluctuations in kidney functioning and blood content, which may have returned to normal by the time the second test is undertaken. As such, results from the academic literature are used to establish the diagnosis of CKD based on a single test (the AHKPI does not provide data on two tests).

Three studies were found that reported on the diagnosis of CKD in one test compared with two tests. Two studies were conducted in the United Kingdom (de Lusignan et al, 2010; Quinn et al, 2008) and one in Tasmania (Jose et al, 2009). When comparing prevalence between one and two tests, they respectively found that only 84.4%, 71.0% and 62.9% of their populations also had an abnormal result indicating impaired kidney functioning at the second test as well. **The average across these studies is 72.8%. This proportion is used to adjust the number of people at risk of CKD to prevalence of CKD**.

3.4.2 Reduced prevalence of CKD complications among DDHS clients

Due to the services delivered by DDHS, it is estimated that there were **88 fewer cases of CKD across the mild to severe risk categories**, compared to what would have occurred if these clients did not receive services from DDHS, after adjusting for the health gap from Zhao et al (2013) – see Table 3.18. This is derived by multiplying the number of regular clients with a complete screening test (1,463) by the proportion in each eGFR/ACR classification for DDHS and non-DDHS clients, and taking the difference between these.

Table 3.18: Change in prevalence of CKD by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	88	-19	-13	-2
45-60	-19	-13	-2	-2
15-45	-2	-2	-2	-2
<15	-2	-2	-2	-2

Source: Deloitte Access Economics calculations.

The reduced prevalence of CKD means that there is also a reduced risk of developing complications from CKD. KDIGO (2013) conducted a meta-analysis of outcomes for all-cause mortality, cardiovascular mortality, kidney failure, acute kidney injury and progressive CKD. **Using all-cause mortality as an example**, Table 3.19 shows the relative risk of all-cause mortality for a person with CKD depending on their eGFR and ACR results as reported by KDIGO (2013). Corresponding tables for cardiovascular mortality, kidney failure, acute kidney injury and progressive CKD are provided in Appendix A.

Table 3.19: Relative risk of all-cause mortality by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<10	*10-30*	*30-300*	*>=300*
>105	1.1	1.5	2.2	5
90-105	1	1.4	1.5	3.1
75-90	1	1.3	1.7	2.3
60-75	1	1.4	1.8	2.7
45-60	1.3	1.7	2.2	3.6
30-45	5.3	3.6	4.7	6.6
15-30	1.9	2.3	3.3	4.9
<15	NR	NR	NR	NR

Source: KDIGO (2013).
Note: NR = not reported.

The results from KDIGO (2013) were adjusted to fit the relative risk categories used in the NT AHKPI Information System, as shown in Table 3.15. For eGFR <15 mL/min/1.73m^2, the relative risk is, conservatively, assumed to be the same as the 15-30 category. Simple averages were used elsewhere where categories overlap.

The adjusted relative risk of all-cause mortality by eGFR and ACR is shown in Table 3.20.

Table 3.20: Adjusted relative risk of all-cause mortality by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	1.0	1.4	1.8	3.3
45-60	1.3	1.7	2.2	3.6
15-45	3.6	3.0	4.0	5.8
<15	3.6	3.0	4.0	5.8

Source: Adapted from KDIGO (2013).

Using these relative risks, the reduced risk among DDHS clients, relative to non-DDHS clients, can be calculated for all-cause mortality. This is weighted by the proportion of people in each eGFR/ACR stage for DDHS clients and no-DDHS clients.

For all-cause mortality, DDHS clients have a relative risk of 1.32 of dying from any CKD complication, compared with relative risk of 1.45 for non-DDHS clients. The incidence of all-cause mortality is 7 per 1,000 patient years, so over 2015-16 for the 1,463 DDHS clients with tests, DDHS would expect 7.5 cases to occur[21], which would have been 8.2 if based on the relative risk faced by non-DDHS clients. Thus, **there are expected to be 0.72 fewer deaths due to any cause as a result of CKD in DDHS regular clients with a screening test**.

[21] This is derived as incidence (0.007) * relative risk (1.32) * number of clients (1,463) * adjustment for prevalence after 2 tests (0.728) * adjustment for health outcome gap (0.76). For the non-DDHS clients – relative risk is the only number that changes to establish the difference in cases that occur.

This process is repeated for kidney failure (end-stage renal disease), acute kidney injury and progressive CKD using the relative risks and incidence reported by KDIGO (2013). The relative risk reported by KDIGO (2013), and the relative risk adjusted to the eGFR and ACR levels reported in the AHKPI Information System, are reported for kidney failure, acute kidney injury and progressive CKD in Appendix A.

Table 3.21 summarises the results from the meta-analysis by KDIGO (2013) applied to the KPI data for DDHS and non-DDHS clients. **The results indicate that there are estimated to be 0.59 fewer cases of kidney failure, 0.40 fewer cases of acute kidney injury and 0.93 fewer cases of progressive CKD**.

Table 3.21: Change in expected events due to DDHS services, 2014-15

Level of risk	Incidence	Relative risk DDHS	Relative risk non-DDHS	Difference in relative risk	Reduction in expected events
All-cause mortality	0.00700	1.32	1.45	0.13	0.72
Kidney failure (end-stage renal disease)	0.00004	34.86	53.16	18.29	0.59
Acute kidney injury	0.00098	2.20	2.71	0.51	0.40
Progressive CKD	0.00202	2.29	2.86	0.57	0.93

Source: KDIGO (2013), NT AHKPI Information System (2015) and Deloitte Access Economics calculations.
Note: the relative risks in these tables are calculated by taking the sum of the relative risks reported in Table 3.20 multiplied by the proportion of people in each category in Table 3.17 for DDHS and non-DDHS clients, respectively.

3.4.3 Calculating the value of reduced prevalence of CKD

The avoided CKD-related complications among DDHS clients are used to estimate the health system and burden of disease costs that are averted, relative to non-DDHS clients.

3.4.3.1 Health system costs averted

For people with CKD, the cost of treatment is estimated to be $9,835 as reported in section 3.3.1. This excludes the cost of dialysis treatment, which is estimated to be $70,641 per person in 2015-16 (Deloitte Access Economics, 2011).

The estimated health expenditure for kidney failure includes both dialysis and the cost of treating CKD generally, while an episode of acute kidney injury and progressive CKD are assumed to be the average cost of treating CKD – $9,835 per person per episode. Multiplying these costs by the number of events avoided gives health system savings of $47,572 for end-stage renal disease, $3,959 for acute kidney injury and $9,188 for progressive CKD**. The total health system savings are estimated to be $60,719 in 2015-16**, as shown in Table 3.22.

3.4.3.2 Burden of disease costs averted

To determine the value of life saved, disability weights for end-stage renal disease were obtained from the 2013 Global Burden of Disease Study (Vos et al, 2015), as the weighted average of:

- end-stage renal disease, with kidney transplant (0.024); and
- end-stage renal disease, on dialysis (0.571).

The disability weight for end-stage renal disease was based on Australia and New Zealand Dialysis and Transplant Registry data for 2011, where 87% of new cases of end-stage renal disease are on dialysis and 13% have received transplants (Grace et al, 2012).

The disability weight for acute kidney injury and progressive CKD were assumed to be the same as Stage IV CKD (0.104) as reported by Vos et al (2015). However, for acute kidney injury, the duration must be less than three months otherwise it will be diagnosed as CKD. The disability weight is adjusted by the maximum duration to give a disability weight of 0.026.

The majority of savings are due to the prevention of loss of life due to any cause. The average age of an Indigenous person with CKD is 48 (ABS, 2014a), with approximately 27 years of expected life remaining at this age (ABS, 2013). Assuming that the average death due to cardiovascular events is at this age, then there are 18.8 years of life remaining in NPV terms (discounted at 3%), saving 13.5 years of life in 2015-16 (18.8 years of life remaining * 0.72 events). Multiplying the change in events by the VSLY, **the incremental benefits of improved chronic disease management are expected to be $2.68 million in 2015-16**.

3.4.3.3 Total economic costs averted

The total economic costs averted due to DDHS services are shown in Table 3.22.

Table 3.22: Incremental benefits of DDHS services on CKD

Complication	Disability weight	Saved YLD	Saved YLL	Value of life saved, $	Health expend savings, $	Total savings, $
All-cause mortality	-	-	13.5	2,599,941		2,599,941
Kidney failure (end-stage renal disease)	0.502	0.297	-	57,027	47,572	104,599
Acute kidney injury	0.026*	0.010	-	2,013	3,959	5,972
Progressive CKD	0.104	0.097	-	18,683	9,188	27,871
Total				**2,677,665**	**60,719**	**2,738,383**

Source: KDIGO (2013), Vos et al (2015), Grace et al (2012) and Deloitte Access Economics calculations.
* the disability weight for acute kidney injury is assumed to be the same as stage IV CKD (0.104), but is adjusted by duration (a maximum of 3 months of a year).

Overall, the total incremental benefits of DDHS services for CKD and its complications are estimated to be $2.74 million in 2015-16 – comprised of $0.06 million in avoided health system costs and $2.68 million in reduced burden of disease.

There would be other economic benefits associated with various CKDs. For example, acute kidney injury and progressive CKD are associated with higher mortality rates. However, no data were available to determine the value associated with preventing these occurrences. As such, the estimated total economic costs averted are likely to be conservative.

4 Cost-benefit analysis results

This section presents the results of the cost-benefit analysis, and identifies previous work that has been done in the area. Overall, DDHS is estimated to provide substantial benefits relative to its costs of providing this care.

4.1 Summary of benefits

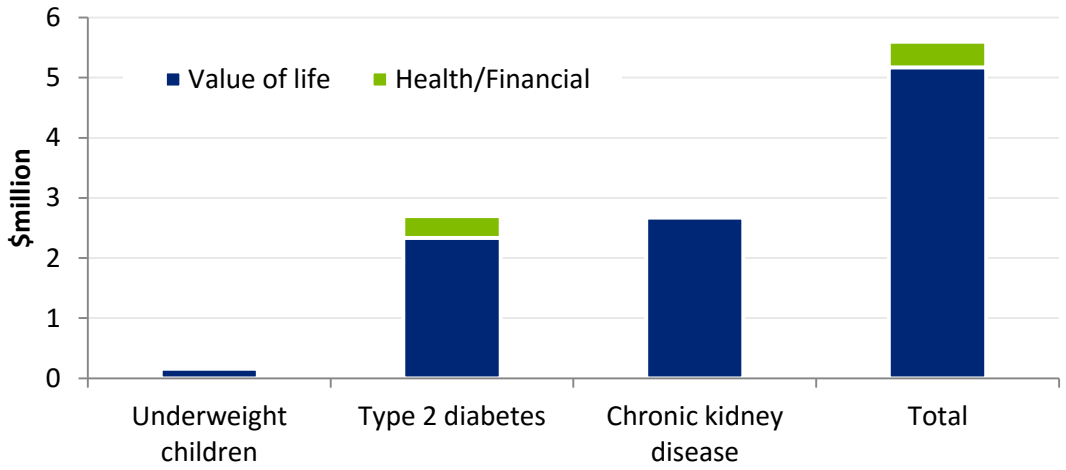
The benefits of DDHS services include improved maternal and childhood health, type 2 diabetes management and CKD screening and management. The methodology and parameters used to estimate these benefits are outlined in chapter 3. It is important to note the benefits reported are incremental as the results are compared to non-DDHS clients.

Table 4.1: Summary of benefits

Benefit stream	Health/ financial	Value of life	Total
Maternal and childhood health	-	0.16	**0.16**
Type 2 diabetes management	0.37	2.33	**2.70**
CKD screening and management	0.06	2.68	**2.74**
Total	**0.43**	**5.17**	**5.60**

Source: Deloitte Access Economics calculations.

Chart 4.1: Benefits of DDHS services in 2015-16, $ million



Source: Deloitte Access Economics calculations.

Overall, DDHS services were estimated to contribute $5.60 million in incremental benefits based on improved health outcomes for its clients. This is comprised of $0.43 million in avoided health and other financial costs, and $5.17 million in improved value of life (Chart 4.1).

4.2 DDHS costs

In order to evaluate the cost-benefit ratio of DDHS services in 2015-16, it is necessary to calculate the costs incurred by DDHS to provide services. As the benefits of DDHS services are incremental to other service providers, it is also necessary to consider the incremental costs of providing these services. To do this, the expenditure per episode of care was compared across organisations in the NT to the expenditure per episode of care for DDHS services.

To determine the cost per episode of care, data were collected from publicly available annual reports. Table 4.2 presents the total expenditure and episodes of care for a number of organisations, who have been de-identified. Collectively, these organisations represent approximately 40% of all episodes of care provided in the NT, and can be considered representative of the whole.

Table 4.2: Summary of costs

Organisation	Expenditure	Episodes of care
DDHS*	17,423,801	54,469
Organisation 1	38,912,314	167,538
Organisation 2	14,535,989	39,164
Organisation 3	18,640,237	55,575
Organisation 4	18,371,210	53,654
Organisation 5	14,473,047	38,080
Total	**104,446,684**	**354,011**

Source: Relevant annual reports as listed in References; NT AHKPI Information System (2015).
* The number of episodes of care for DDHS is taken from data provided for NT AHKPI reporting. This is a lower number than is reported in the 2015 Annual Report (58,376), because the Annual Report data include people without a Greater Darwin address. The data from the NT AHKPI is used in the cost-benefit calculations as the benefits calculations are also based on NT AHKPI data.

For other NT providers, the average expenditure per episode of care was $296.41 in 2014-15 dollars. For DDHS, the average expenditure per episode of care was $319.88 in 2014-15 dollars. Multiplying the difference in expenditure per episode of care by the total episodes of care delivered by DDHS gives the incremental costs of providing services. In 2015-16 dollars, DDHS incurred $1.34 million in incremental costs providing care to its clients.

4.3 Summary of results

DDHS incremental benefits were estimated to be approximately $5.60 million for 2015-16. The incremental cost to provide these benefits was estimated to be approximately $1.34 million. The estimated BCR was 4.18, and the ROI was 318%.

Table 4.3: Cost-benefit results

Costs	$1.34 million
Benefits	$5.60 million
Net benefits	$4.26 million
BCR	4.18
ROI	318%

Source: Deloitte Access Economics calculations.
Note: Costs are the incremental costs of DDHS. Benefits are the avoided costs due to DDHS in 2015-16. Net benefits are calculated by subtracting costs from benefits. The BCR is calculated by dividing benefits by costs.

It is important to note that this cost-benefit analysis has not established a causal link between DDHS and the cost savings included in the analysis. While statistically significant reductions in the economic costs of conditions have been established, it is possible that some of this reduction would exist even in the absence of DDHS. The adjustment for the health gap goes some way to adjust for this. However, it is not possible to fully identify the impact of DDHS services as individual patient data were not available for the entirety of the NT.

4.4 Health benefits from comparable programs

A supplementary review of existing academic and grey literature was conducted to identify published studies quantifying the health benefits of comparable health care programs in similar circumstances. **There is limited evidence available for similar programs.**

Thomas et al (2014) aimed to evaluate the costs and health outcomes associated with primary care use by Indigenous people with diabetes in remote communities in the NT. The study compared health care costs for people with low to high primary care use. The study found that the medium and high use groups had lower rate of hospitalisation, potentially avoidable hospitalisations, and deaths. In the work by Thomas et al (2014), the cost of preventing one hospitalisation was $248 for those in the medium use group and $739 in the high use group, which compared to average hospitalisation costs of $2,915 – indicating a BCR of over 12 for medium use of primary health care, and over 4 for high use of primary health care.

A similar study by McDermott and Segal (2006) assessed the cost impact of improved quality services in primary health care for Indigenous people with type 2 diabetes in the NT. The intervention was an improved diabetes service – including visiting specialists, care plans, additional training and information systems – which was compared to standard care. In NPV terms, the costs of the improved program were estimated to be $2.61 million over 6 years, with estimated benefits of $2.06 million. The BCR of this intervention was 0.8. McDermott and Segal (2006) note that it would be beneficial to include the value of life and mortality avoided, which as shown in chapters 3 and 4, contribute substantial benefits from primary health care services.

Vos et al (2010) conducted analysis of the value of a number of intervention strategies to prevent death and disease in Australia. The *Assessing Cost-Effectiveness in Prevention* project evaluated 150 preventative health interventions. The project considered the benefits and costs of an Indigenous health services delivery template delivered by

Aboriginal community-controlled health services compared to general GP services. The services provided by Aboriginal community-controlled health services were more expensive, although more utilised – consultation costs were $30.85 for general GP services and $113.18 for Aboriginal services. However, the increased costs resulted in better adherence and treatment outcomes. The cost offset ratio was reported as 1.19, irrespective of service type. The primary reason for this was that Indigenous patients have higher treatment costs on average due to greater comorbidities and severity of disease, which leads to higher potential savings.

The Institute of Urban Indigenous Health aims to deliver accessible, efficient, effective and comprehensive primary health care by community-controlled health services. In its 2013-14 annual report, the Institute noted that it had commissioned a cost-benefit analysis using data from two clinics (as at February 2016, the cost-benefit analysis had not been publicly released). It is not clear what assumptions underlie the modelling; however, extrapolating benefits to all their clinics in South East Queensland, the results indicate net benefits of $237 million over 10 years based on existing and continued investment in these clinics.

Overall, it is clear that Indigenous primary health care can substantially improve quality of life, and avoid health system costs, resulting in overall net benefits to NT (and thus Australian) society. This corresponds with the findings in chapters 3 and 4, although it was not possible to make direct comparisons of these findings as no studies with sufficiently similar methodology were identified.

5 Analysis of DDHS cost drivers

This chapter analyses selected cost drivers which will place increased demand on DDHS resources in future years. **In the absence of additional resources, these cost drivers will negatively impact on DDHS' ability to deliver primary health care to Indigenous residents of Greater Darwin.** The cost drivers have been grouped into supply-side cost drivers and demand-side cost drivers, and are discussed in the following sections.

5.1 Supply-side cost drivers

As DDHS is located in Darwin, it experiences problems with staff retention and recruitment that are not faced to the same extent by comparable organisations in other locations throughout Australia. This negatively impacts DDHS' ability to deliver services at a sufficient quality and volume to Indigenous residents of the Greater Darwin region, with resulting impacts for the health of these people.

A survey of northern Australian[22] employers' recruitment experiences by the Department of Employment (2015) in 2014-15 found that Darwin was the only region where recruitment difficulty and staff retention were flagged as significant future concerns by employers.

5.1.1 Staff recruitment

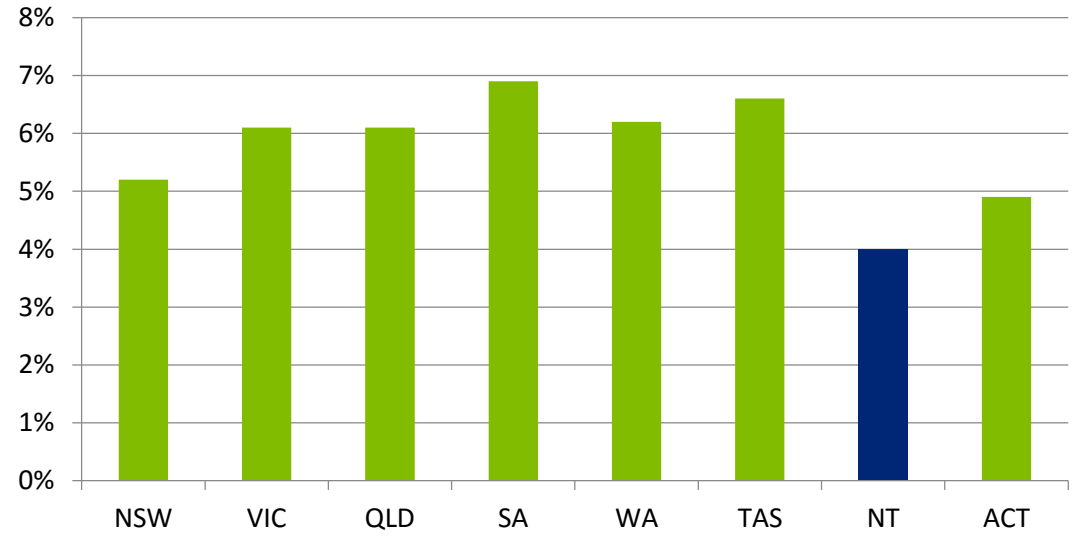
In 2014-15, **Darwin experienced the highest proportion of employers reporting recruitment difficulties** (63%) of all the northern Australian regions, which is an increase from 56% in 2012-13. The next highest region was Outback Queensland (44%), with the average across all regions being 41% (Department of Employment, 2015).

The report noted a key difficulty with recruiting staff in Darwin was that there were fewer applications when a job was listed: Darwin employers received on average seven applicants per vacancy, compared to an average of ten across all regions. **In addition, employers in Darwin (as well as Outback Queensland) were most likely to report recruitment difficulties when recruiting for higher skilled occupations** (Department of Employment, 2015).

This low number of applicants for each position reflects the low unemployment rate in the NT. As shown in Chart 5.1, across all states and territories in January 2016, **the NT had the lowest trend rate of unemployment** (4.0%), compared to the highest rate (South Australia, 6.9%), and 0.9% percentage points lower than the second lowest rate (Australian Capital Territory, 4.9%). The low unemployment rate means that more people are employed and thus not looking for work, and so employers who want to hire more staff have a smaller pool of people to choose from (ABS, 2016).

[22] Defined as all regions north of the Tropic of Capricorn.

Chart 5.1: Trend rate of unemployment by jurisdiction, January 2016



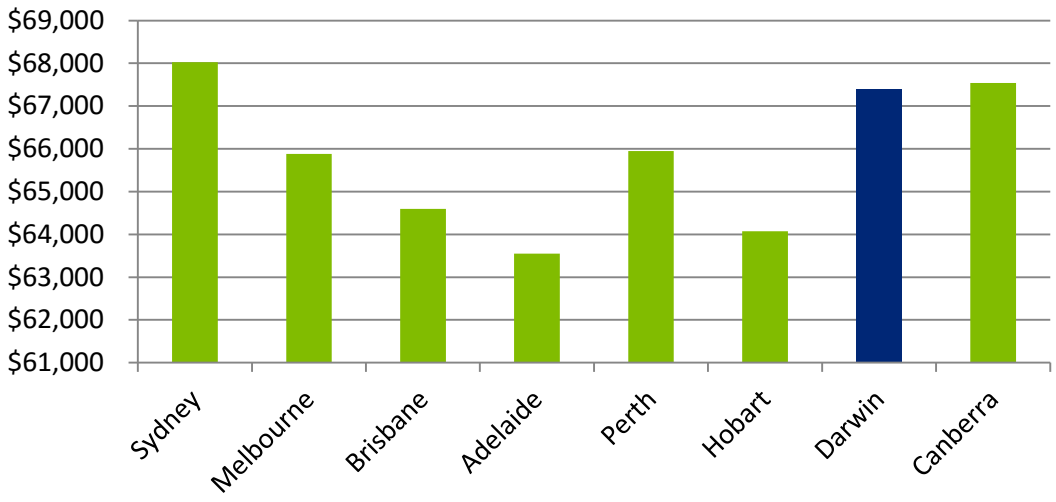
Source: ABS (2016).

Recruitment difficulties are exacerbated by the high cost of living in Darwin relative to the rest of Australia, which makes it difficult to attract suitably qualified staff from other regions and states. Analysis by the National Centre for Social and Economic Modelling in December 2013 (Phillips, 2013) found that Darwin had the third highest cost of living of all the capital cities, behind Sydney and Canberra.

This analysis was based on ABS data pertaining to household expenditure, consumer price indices, national accounts, and housing finance, and interest rate data from the Reserve Bank of Australia. The final estimated cost of living in each city represents a typical household basket of goods, which is regularly updated to ensure the basket of goods is appropriate to the point in time, which minimises any bias from changes in consumption patterns (ABS, 2015).

Across the capital cities, Sydney ($68,023), Canberra ($67,537) and Darwin ($67,406) were the most expensive cities to live in (see Chart 5.2).

Chart 5.2: Cost of living in each capital city, 2013



Source: Phillips (2013).

5.1.2 Staff retention

The Department of Employment survey found that in 2014-15, 35% of employers in Darwin reported experiencing problems with staff retention. This was the highest in the northern Australian region with the next highest being the Kimberley region at 20%, and the average across all regions being 5% (Department of Employment, 2015).

The difficulties associated with staff retention are reflected in the relatively high turnover (30%) among DDHS staff in 2014-15 (DDHS, 2015). This compares to an Australian average of approximately 20% in 2012 (D'Arcy et al, 2012).

5.1.3 Business costs

Business owners in Darwin experience high costs of doing business. According to data from the ABS, Darwin had the second highest average electricity price when compared to other capitals cities; the highest was Brisbane at $139.4 followed by Darwin at $132.4, while the average was $119.175. Likewise for utility costs, Darwin had the highest average utility cost (132.875), with the average being 119.375 for all of Australia (ABS, 2015).

5.2 Demand-side cost drivers

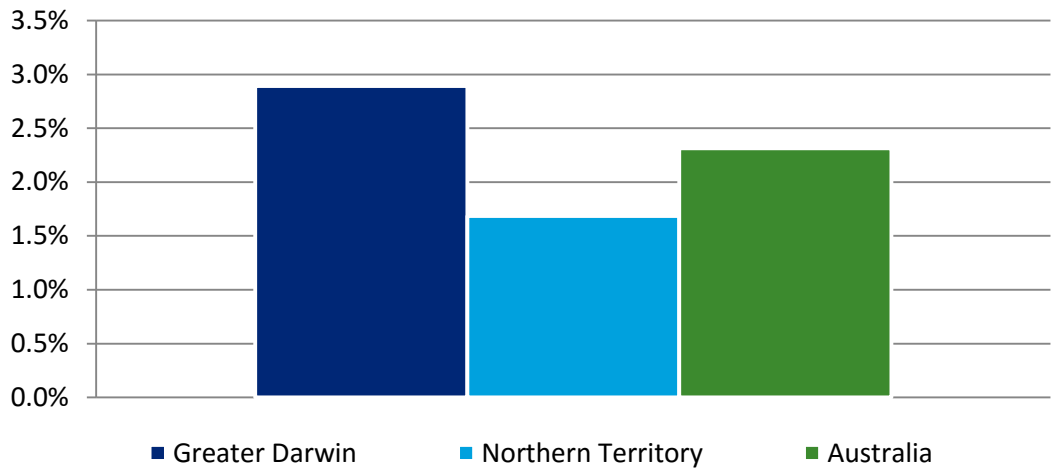
There are several demand-side elements which will impact on the service delivery costs of DDHS. These are explored in the following sections.

5.2.1 Population growth

While population growth will place cost pressure on all service delivery organisations in the health sector, the population growth rate of the NT Indigenous population is forecast to be higher than the growth rate in the rest of Australia.

The growth in population of the Greater Darwin population over the next ten years is increasing at a rate higher than the rest of Australia, which will lead to a greater increase in demand for health services in Greater Darwin. Over the ten years to 2026, the Greater Darwin Indigenous population is forecast to increase at a faster rate (2.9% per annum) than both the Australian Indigenous population (2.3% per annum) and the NT Indigenous population (1.7% per annum), as shown in Chart 5.3. This will place increased demands on DDHS as more patients will be requiring services.

Chart 5.3: Average Indigenous population growth rate per annum, 2016-2026



Source: NT Department of Treasury and Finance (2014); Deloitte Access Economics calculations.

5.2.2 Prevalence of chronic disease

The prevalence of chronic disease in the NT will face further cost pressures on DDHS, as their target population will require additional services to address these health concerns.

Compared to the Australian average for Indigenous people, the NT Indigenous population has higher prevalence of (ABS, 2014a):

- Diabetes: 10.0% compared to the national average of 8.2%. Diabetes is a highly prevalent chronic health condition where the body is unable to adequately manage the level of glucose in the blood. Diabetes and its comorbidities are leading causes of death, illness and disability in Australia.
- Heart and circulatory problems: 13.6% compared to 12.0% nationally. These conditions include cardiovascular conditions such as high blood pressure and coronary heart disease[23]. In 2007, the AIHW estimated that cardiovascular conditions contributed 18.0% of all burden of disease in Australia (Begg et al, 2007).
- CKD: 1.8% compared to the national average of 1.7%. CKD occurs when the body is not able to clear waste products from the blood in a timely manner, and places people at

[23] The full list of conditions includes hypertensive disease; ischaemic heart diseases; other heart diseases; tachycardia; cerebrovascular diseases; oedema; diseases of the arteries, arterioles and capillaries; diseases of the veins, lymphatic vessels, etc.; other diseases of the circulatory system; and symptoms and signs involving the circulatory system.

increased risk of requiring dialysis and/or kidney transplants, developing cardiovascular disease, and death.

These rates for the NT and Australia are summarised in Table 5.1.

Table 5.1: Prevalence of chronic disease among Indigenous people

Condition	NT (%)	Australia (%)
Diabetes and high sugar levels	10.0	8.2
Heart and circulatory problems	13.6	12.0
CKD	1.8	1.7

Source: ABS (2014a)

5.2.3 Mortality

Another measure of general health status within a population is the estimated life expectancy of people within the population. A shorter life expectancy is indicative of worse health status throughout a person's life, and implies that more health services will be required by that person due to the lower standard of health.

Life expectancy measures how long a person is expected to live, if current mortality rates remain constant at each age group throughout each person's life. Life expectancy is affected by a number of factors, such as health behaviours (for example, smoking and exercise), social determinants (for example, income, education and employment), access to health services, and environmental factors (for example, pollution and sanitation) (AHMAC, 2015).

Analysis by the AIHW (2014b) shows that life expectancy among Indigenous males (63.4 years) and females (68.7 years) in the NT is the lowest out of New South Wales, Queensland, Western Australia and NT (other jurisdictions were not included in the AIHW analysis). In addition, mortality rates in the NT, which measure the number of deaths per 100,000 people in the population, are the highest of the states included in the report. These results are summarised in Table 5.2.

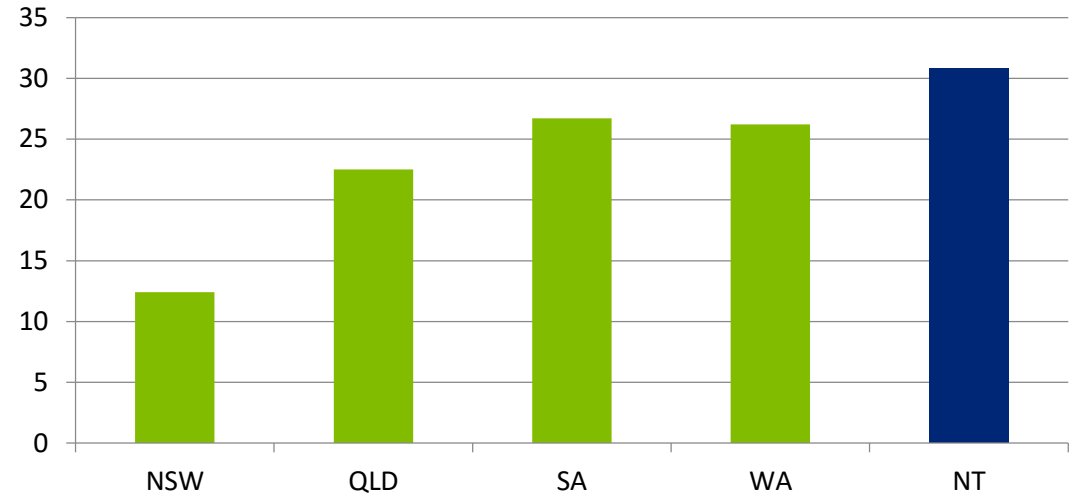
Table 5.2: Jurisdictional mortality rates, 2010-2012

Jurisdiction	Life expectancy		Mortality rate per 100,000
	Males	*Females*	
New South Wales	70.5	74.6	786.4
Queensland	68.7	74.4	947.9
Western Australian	65.0	70.2	1,290.6
Northern Territory	63.4	68.7	1,461.0

Source: AIHW (2014b).

In addition to all-cause mortality, suicide rates among NT Indigenous people are the highest in Australia, at 30.8 suicides per 100,000 people (see Chart 5.4).

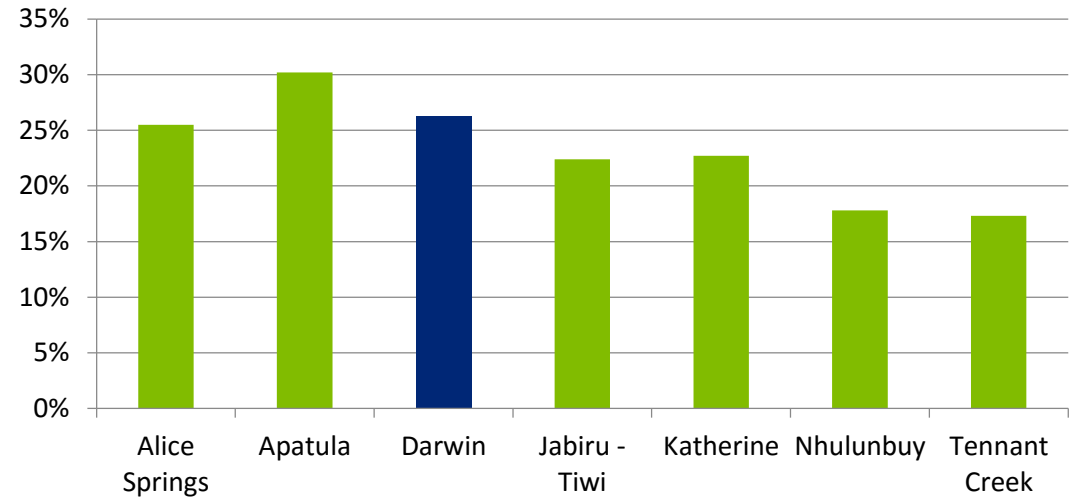
Chart 5.4: Indigenous suicide rates per 100,000 people, by jurisdiction



Source: ABS (2012).

The proportion of Indigenous people who report high or very high levels of psychological distress in Darwin is 26.3%, which is second only to Apatula (30.2%), and above the NT average of 23.3% (see Chart 5.5). Among adults who score high or very high on the Kessler 10 Psychological Distress Scale[24], approximately 57% and 80%, respectively, have a mental disorder (Slade et al, 2011).

Chart 5.5: Proportion of population with high/very high levels of psychological distress



Source: ABS (2014a).

[24] The ABS uses a modified five-question version of the Kessler Psychological Distress Scale. This tool is used to measure non-specific psychological distress. People who score highly on the scale may experience feelings of anxiety or distress regularly, whereas a low score means that these people experience these feeling infrequently or not at all.

5.2.4 Proportion of clients who are Indigenous

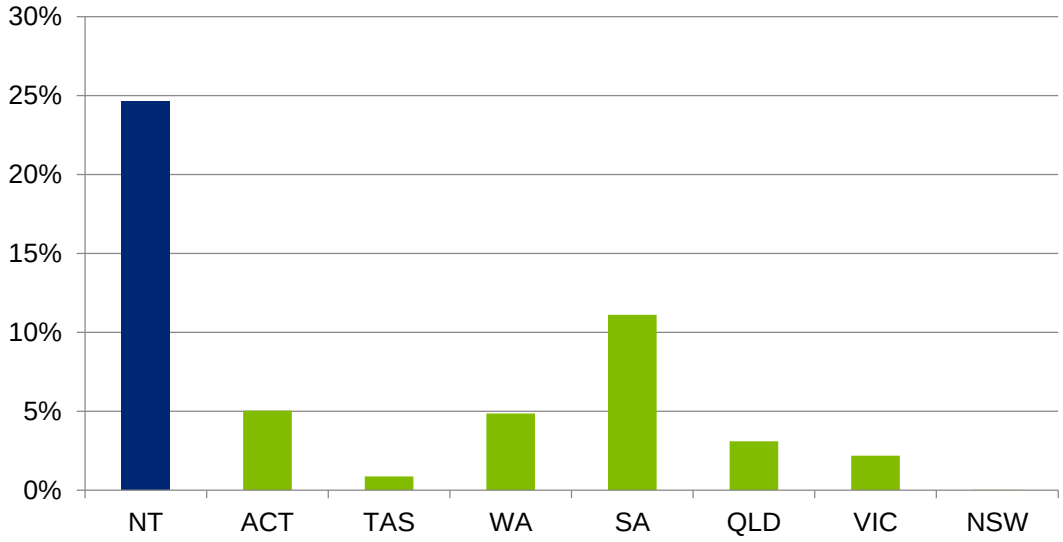
As a proportion of all patients, Indigenous patients at DDHS represent 94% of total clients (see Section 1.1). This compares to an average of 80% across all Aboriginal community-controlled health services that provided data to the AIHW (2015). Indigenous people utilise GP services at a higher rate (6,376 services per 100,000 people) than non-Indigenous Australians (5,462 per 100,000 people), which places greater demand on DDHS services (AHMAC, 2015)

5.2.5 Housing

Another demand-side cost driver for DDHS is the lack of appropriate housing for many Indigenous people in the NT, as housing has been identified as one of the key social determinants of health (Havnen, 2012). The lack of appropriate housing is reflected in the proportion of Indigenous people who are homeless, and the proportion of Indigenous people who live in overcrowded households.

As shown in Chart 5.6, in 2011-12 25% of the NT Indigenous population were homeless, compared to an average of 6% across all states and territories.

Chart 5.6: Percentage of Indigenous population who are homeless



Source: Homelessness Australia (2012)

Typically, people who are homeless have poorer health than the general community and consequently are in need of more health services. People who are homeless typically have insufficient resources to meet their daily needs which can result in malnutrition and a multitude of other health problems. There is also a higher prevalence of mental health issues amongst the homeless population (Holmes, 2008). These factors combine to place greater need on the mobile van operated by DDHS, which provides services to the homeless population.

In addition to the relatively large homeless population, over half of the NT's Indigenous population is living in overcrowded housing, which is significantly higher than other

jurisdictions (see Chart 5.7). Across Australia, Indigenous households are three times more likely than non-Indigenous households to be overcrowded.

Chart 5.7: Percentage of Indigenous population living in overcrowded housing, 2012-13

Source: Steering Committee for the Review of Government Service Provision (2014).
Note: "Overcrowding" is defined as households which require at least one additional bedroom, based on the Canadian National Occupancy Standard for Housing Appropriateness.

Overcrowding has been linked to a range of negative outcomes such as poor early childhood development and educational outcomes, domestic violence, child neglect and failure to thrive, ear disease and hearing damage, and trachoma (Havnen, 2012). The relatively high rate of population growth among Indigenous people in Greater Darwin (see Section 5.2.1) will mean that the number of Greater Darwin residents in overcrowded housing will grow at a faster rate than in the rest of NT and Australia, which will place greater demand on DDHS services.

6 Funding comparison

This section compares the funding received by DDHS relative to the funding received by similar organisations. Much of the data used in this section is not publicly available, and so is not reported at the individual organisation level. Rather, averages across all organisations have been compared to publicly available data from DDHS[25].

DDHS nominated the following organisations as providing services which are similar to DDHS services. All these organisations have a focus on providing primary health care to Indigenous people.

- Central Australian Aboriginal Congress (NT)
- Broome Regional Aboriginal Medical Service (Western Australia)
- Derbarl Yerrigan Health Service (Western Australia)
- Institute of Urban Indigenous Health (Queensland)
- Townsville Aboriginal and Torres Strait Islander Corporation for Health Services (Queensland)
- Wurli-Wurlinjang Health Service (NT)
- Miwatj Health Aboriginal Corporation (NT)
- Anyinginyi Health Aboriginal Corporation (NT)

Background information on these organisations is provided at Appendix B.

> In summary, DDHS receives less funding per staff member, less funding per episode of care and less funding per person in its target population, than is received by the comparator organisations. This negatively impacts on DDHS' ability to deliver high quality services at a sufficient volume.

6.1 Funding received by DDHS

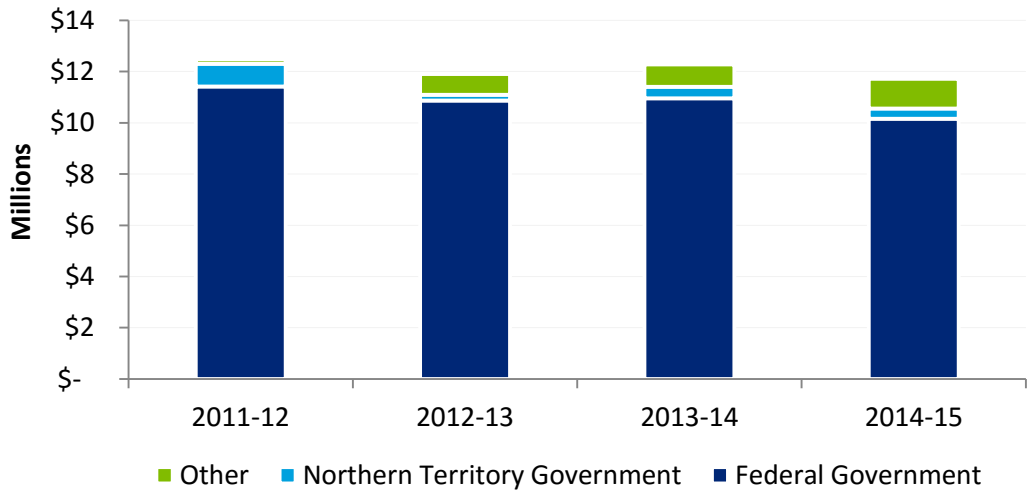
In 2014-15, DDHS received approximately $12.5 million in grant funding. The Department of Health (DOH) was the main source of funding and gave a total of $9.7 million. Other departments that DDHS received funding from during 2014-15 were the PM&C ($0.9 million), the Department of Social Services (DSS, $0.4 million), and the NT DOH ($0.4 million).

Over the past four years, the composition of DDHS' grant income has changed. Total grant income from both state and federal governments has decreased, while other grant income from non-government sources has increased.

[25] Some organisations did not provide a complete set of data. These organisations have been excluded from calculations for the relevant metrics.

DDHS funding from the Australian Government has decreased from $11.4 million in 2011-12 to $10.2 million in 2014-15, while funding from the NT Government has decreased from $0.9 million in 2011-12 to $0.4 million in 2014-15. Overall, total grant funding from 2011-12 to 2014-15 has decreased. There has been some offset to the decrease in government funds by increases in funding from non-government sources such as through the NT General Practice Education programs. The changing composition of DDHS' grant funding is shown in Chart 6.1.

Chart 6.1: Federal, state and other grant funding



Source: DDHS (2015).

6.2 Funding comparisons

Funding comparisons are made in regards to: funding per staff member, funding per episode of care, and funding per Indigenous person in each organisation's target area. These are discussed in the following sections.

6.2.1 Funding per staff member

The amount of funding received by an organisation directly impacts on its ability to hire an appropriate amount of staff to provide services to its clients – at DDHS, approximately two thirds of expenditure is spent on labour costs, and this proportion is similar across all the organisations reviewed for this report. More staff allows more time and energy to be directed to patients, with resulting improvements in health outcomes. It also means that staff are less likely to be overworked, or seek to join and organisation with a more appropriate level of staffing where the demands on their time are less onerous.

In 2014-15, DDHS received lower than average funding per staff member when compared to the other organisations. DDHS received $98,775 per full-time equivalent (FTE), while on average the comparator organisations received $123,852.

This relative lack of funding directly impacts the ability of DDHS to employ a sufficient level of staff relative to the number of services demanded by its clients. **In 2014-15, each FTE at DDHS provided an average of 460 episodes of care to its clients, compared to an average**

across the comparator organisations of 418 episodes of care per FTE. These calculations demonstrate that each DDHS staff member is able to spend less time on each episode of care, which may impact on the quality of care that can be delivered to clients.

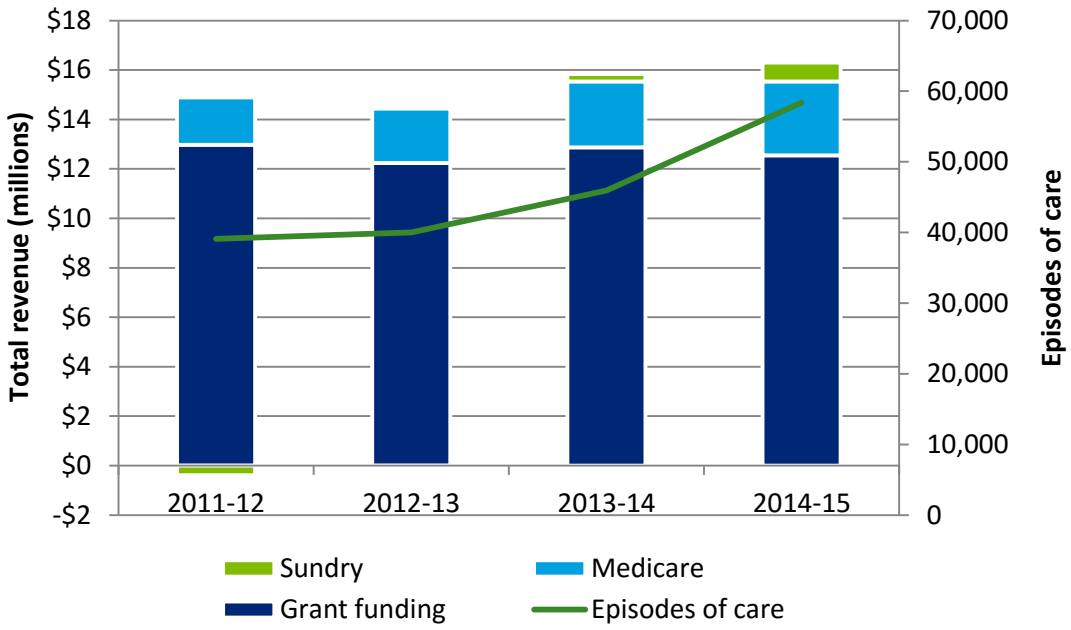
6.2.2 Funding per episode of care

The amount of funding that DDHS receives influences the volume of care that it can provide to its clients. Compared to the other organisations, DDHS received $215 in grant funding per episode of care delivered, compared to $282 across the comparator organisations. This means that **DDHS provided 4.7 episodes of care per $1,000 of grant funding received, compared to 3.5 episodes of care across the comparison organisations.** While the DDHS episodes of care were delivered with less grant funding, the cost of providing these services at DDHS ($320 per episode of care) was slightly higher than at the other organisations ($296 per episode of care), as outlined in Section 4.2[26].

A relatively lower level of grant funding, combined with a relatively higher cost of service delivery, means that DDHS is required to access alternative sources of revenue and/or reduce its cost of service delivery relative to the other organisations. As shown in Chart 6.2, over 2011-12 to 2014-15, DDHS significantly increased the number of episodes of care it provided (by 49%), but only increased total revenue by 12%. While total grant funding decreased over this period, the other major source of revenue, Medicare receipts – which generally rises in line with the number of episodes of care delivered – increased by 56% which offset the decrease in grant funding. DDHS has also decreased its average cost per episode of care by 11% over 2011-12 to 2014-15.

[26] As noted in Section 4.2, the calculations of average cost are based on episodes of care reported in NT AHKPI Information System (2015). If the number of episodes of care from the DDHS 2015 Annual Report are used, the average cost per episodes of care decreases to $298.

Chart 6.2: Total revenue and episodes of care, 2011-12 to 2014-15



Source: DDHS (2015, 2014, 2013, 2012).

6.2.3 Funding per Indigenous person in the target population

The DDHS target population resides in the Greater Darwin area, with 80% of Indigenous residents in this area receiving services from DDHS in 2014-15. The amount of funding received by DDHS relative to the number of Indigenous people in the target population will impact on its ability to meet the needs of these people.

Funding per Indigenous person was calculated by dividing total grant funds by the number of Indigenous people in the target population. **In 2014-15, DDHS received less funding per Indigenous person in their target area**. On average, the comparator organisations received $1,476 per Indigenous person in their target area, while DDHS received $806 per Indigenous person in their target area.

This relative lack of funding means that DDHS is not able to provide as many services per Indigenous person in the target area as is provided by the comparator organisations. Episodes of care per Indigenous person was calculated by dividing the episodes of care for 2014-15 by the target Indigenous population. In 2014-15, DDHS provided an average of four episodes of care to each Indigenous person in its target area, compared to an average of eight episodes of care which were provided by the comparator organisations.

7 Assessment of funding against program guidelines

This section presents information on the various government programs which provided grant funding to DDHS in 2014-15, discusses the selection criteria for these programs which are used to allocate grant funding to organisations such as DDHS, and identifies whether the grant funding received by DDHS is aligned with the principles in the guidelines.

7.1 Programs funded in 2014-15

In 2014-15, DDHS received program funding through a number of government organisations and programs:

- The Australian Government DOH;
  - Indigenous Australians' Health Program;
  - Stronger Futures in the NT Program; and
  - NT General Practice Education Agreement;
- The NT DOH;
- The DSS
  - Royal Commission Community-based Support Services; and
  - Families and Communities Program; and
- The PM&C's Indigenous Advancement Strategy.

The amount of funding received through each of these programs is shown in Table 7.1.

Table 7.1: Grant funding received, 2014-15

Funder	Program name	DDHS program	Amount ($)
PM&C	Indigenous Advancement Strategy	Substance Abuse	331,623
		Social and Emotional Wellbeing	554,023
		Total	*885,646*
DSS	Royal Commission Community-based Support Services	Royal Commission	50,950
	Families and Communities Program	Emergency Relief Funds	48,975
		Dare to Dream*	334,141
		Total	*434,066*
DOH	Indigenous Australians' Health Program	Primary Health Care	6,466,239
		Chronic Disease	540,317
		New Directions – Mothers and Babies	518,340
		Tackling Smoking	384,356
	Stronger Futures in the NT	Remote Services	922,887
		Total	*8,832,139*
NT Primary Health Network	N/A	Care Coordination	1,155,522
		Total	*1,155,522*
NT General Practice Education	Registrar Training Post	Registrar Training Post	830,661
		Total	*830,661*
NT DOH	N/A	Mobile Primary Health Care Service	406,361
		Total	*406,361*
Total			**12,544,395**

Source: DDHS.
Note: * this program ceased operations as funding was not provided for 2015. N/A = not available.

7.2 Program selection criteria

Each of the funding guidelines contain a similar mix of selection criteria which are used to assess which organisations receive funding under each program. While the selection

criteria do differ in some respects (for example, some guidelines may not explicitly include some criteria, and other guidelines may include criteria which are specific to a particular program), the typical selection criteria which are found across a majority of the programs include:

- **Alignment with objectives** – the objectives of the project are aligned with the objectives of the program.
- **Demonstrated need** – the project addresses emerging issues or areas of need in the community.
- **Capacity to deliver** – the organisation is able to commit the necessary resources to the project. This includes having the necessary organisational and staff experience to deliver the required services.
- **Governance** – the project can be implemented within budget and timeframes, the organisation is able to manage and acquit funding in accordance with legislative requirements, and the organisation is able to assess and mitigate risks relating to the project.
- **Value for money** – this criteria is typically the most important selection criteria, and some guidelines bundle other criteria (such as alignment with objectives, and demonstrated need) into "value for money". This criteria is assessed with reference to the money invested relative to the outcomes achieved. Value for money may also be assessed in terms of projects which address objectives and populations which have been identified as higher priority.
- **Community engagement** – the organisation engages and works with the local health professionals and the target community to support the project. This includes Indigenous participation in the design and delivery of the project, and also employing Indigenous people in the project.
- **Culturally appropriate services** – the organisation is able to deliver culturally appropriate services to the community, as these are likely to have a greater influence on health outcomes compared to projects which are not tailored to meet the cultural requirements of each community.
- **Geographic and population coverage** – the geographic area and the population that are targeted by the project. This may also relate to the organisation's capacity to expand the reach of their services to cover additional areas and population groups, and whether the project is aimed at areas or populations which are considered to be higher priority.

> While DDHS meets all of these selection criteria (as demonstrated by the fact that it has received funding under each program), two of the selection criteria make a strong case that an increase to funding is justified. These selection criteria are **demonstrated need** and **value for money**.

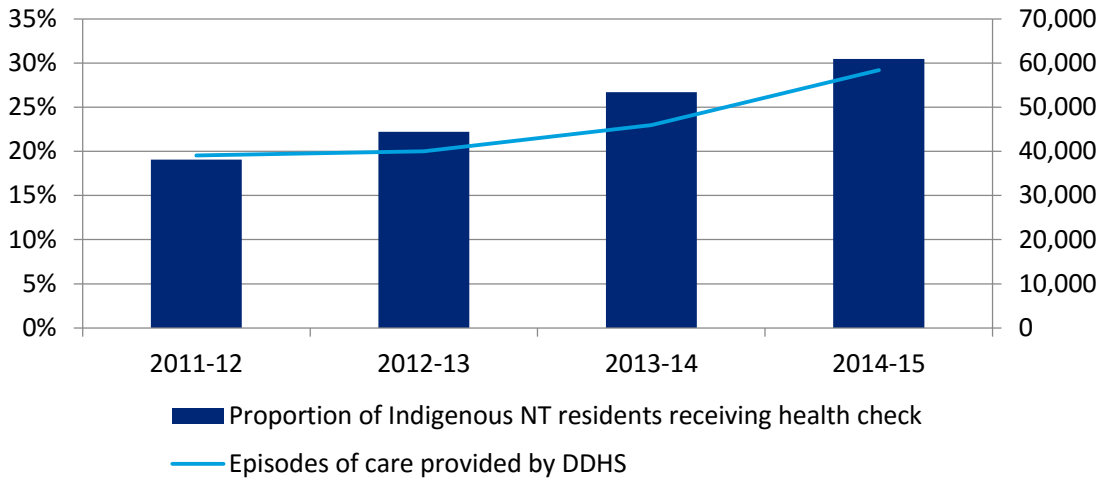
The services provided by DDHS deliver **value for money**. As shown in Chapter 4, each dollar invested in DDHS provides $4.18 of benefits to society, and thus each additional dollar invested into primary health care services provided by DDHS provides a strong return.

There is a demonstrated need for Indigenous primary health care in Greater Darwin, and this need is increasing. Specific data on the use of primary health care by Indigenous residents of Greater Darwin, and the change in usage over time, could not be located for

this report. However, as noted in 1.1, DDHS provides services to approximately 80% of Indigenous residents in Greater Darwin, and thus DDHS data provides a reasonably complete picture of primary health care usage by this population. Between 2011-12 to 2014-15, the number of episodes of care provided by DDHS increased from 39,102 to 58,376, which is an average increase of 12.3% per year.

Another proxy for the use of primary health care services by Greater Darwin residents is the proportion of NT residents who received an Indigenous health check through Medicare. Over 2011-12 to 2014-15, the proportion of Indigenous people in the NT who received an Indigenous health check increased from 19.1% in 2011-12 to 30.5% in 2014-15 (AIHW, 2015). The increase in services provided by DDHS closely matches the increase in the number of Indigenous health check in the NT, as shown in Table 7.2 below.

Table 7.2: Proportion of Indigenous NT residents receiving health checks, and episodes of care provided by DDHS, 2011-12 to 2014-15



Source: DDHS (2015, 2014, 2013, 2012); AIHW (2015).

> While the need for primary health care in the NT is increasing, the available resources to meet this need are inadequate.

The entire NT, including Darwin, is located in a District of Workforce Shortage (NT Health Workforce, 2011). Populations that are in an area that is designated as a DWS have less access to Medicare-subsidised services when compared to the national average (DOH, 2016).

The AIHW has developed the **Access Relative to Need** (ARN) index to measure access to primary health care relative to need at the Statistical Area Level 1 level (AIHW, 2014). The index measures the capacity of GPs in a particular area to meet the primary health care needs of Indigenous people in that area[27].

[27] The predicted need for primary health care was calculated using demographic and socioeconomic variables which have been established as correlating with health outcomes. These included variables from the 2011 Census such as "proportion of people in high needs age groups", "proportion of people who need assistance

While the underlying data on ARN for the Greater Darwin region could not be confirmed with the AIHW[28], analysis of the AIHW publication indicates that the Greater Darwin region has an ARN of 1, which indicates that **Indigenous people in the Greater Darwin region have a very low access to GP services relative to their needs**.

Further analysis by the AIHW (2015b) has identified that **Indigenous people in the NT report problems accessing medical services at a higher rate than the rest of Australia**. In the NT, 12.0% of Indigenous people aged 15 years and over reported that they had difficulty accessing a doctor, compared to the national average of 9.5%, in 2008. For dentists, the rate was 24.1% for the NT, compared to 19.5% nationally. For all other health workers, with the exception of AHPs, the rate for the NT was 4.5%, compared to the national average of 2.6%.

with core activities", "proportion of unemployed people", "proportion of households without access to a motor vehicle", and "proportion of people who have not attained Year 12 or equivalent school or non-school qualification".

Access to GPs is a measure that takes into account travel time, population size, and "competition" (that is, demand) from other people in the area who will also need to access GP services.

Using the predicted need and access to services, the index was validated by analysing the results of the index with rates of ambulatory care sensitive conditions (ACSC) hospitalisations and avoidable deaths amenable to treatment (ADAT) for each region. These were chosen as, by definition, regions with high rates of ACSC and ADAT have an unmet primary health care need. The validation process confirmed that these two health outcomes improved significantly with improved access to GPs in the areas with relatively high predicted need, with a less significant increase observed in areas with a lower predicted need. Health outcomes are closely correlated with access to GPs in areas which have a high predicted need for primary health care.

[28] The AIHW has advised that the exact ARN results for each region are not publicly available.

Conclusion

There is an increasing need for primary health care in the NT; the latest *Closing the Gap* report, released in February 2016, highlights that **Australia is not on track to close the gap in life expectancy between Indigenous and non-Indigenous Australians by 2031** – the primary target for health outcomes (PM&C, 2016). The report notes that it is **"…important to accelerate progress"** to close the gap in life expectancy (PM&C, 2016, p.42).

The cost-benefit analysis shows that **DDHS delivers value for money in improving Indigenous health outcomes**. The cost-benefit analysis indicated that each dollar invested in DDHS provides $4.18 of benefits to society, and thus, **each additional dollar invested into primary health care services provided by DDHS provides a strong return**. Currently, DDHS is able to deliver these improved health outcomes to almost 80% of the Greater Darwin Indigenous population.

However, the funding comparisons show that DDHS receives less funding per staff member, less funding per episode of care and less funding per person in its target population, than is received at the average comparator organisation. Further, DDHS has observed a decrease in total grant funding since 2011-12. These factors may be negatively impacting on DDHS' ability to deliver high quality services at a sufficient volume to maintain or improve health outcomes in the Greater Darwin population. In addition to these funding constraints, DDHS faces cost pressures from both **supply and demand-side cost drivers which have the potential to negatively impact on DDHS' ability to deliver primary health care** to Indigenous residents in Greater Darwin.

This report has demonstrated that DDHS delivers superior health outcomes compared to those delivered by comparable health services. As a result of the higher quality service, DDHS' cost per service is also higher, but DDHS receives less grant funding to provide these services. **As DDHS provides superior quality of care, it is reasonable to conclude that, at a minimum, the grant funding given to DDHS should be increased to be in line with the grant funding received by the comparator organisations**.

The grant funding provided to comparator organisations to fund the cost of service delivery is 25% higher in terms of funding per FTE, and 31% higher in terms of funding per episode of care (see Section 6.2). Thus, **this report recommends that DDHS grant funding be increased by between 25% and 31% – this is an increase of between $3.1 million and $3.9 million**, based on 2014-15 funding levels (and would be spread across all the programs contained in Table 7.1).

The analysis in this report has shown that there is a **demonstrated need for Indigenous primary health care in Greater Darwin**, and the latest *Closing the Gap* report attests to the continuing gap in health outcomes between Indigenous and non-Indigenous Australians.

> Investing additional funding into DDHS would represent a sound investment in improving Indigenous health in the NT, and would assist with further closing the gap in Indigenous health outcomes.

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Appendix A: Relative risks of complications for CKD

As discussed in section 3.4.2, results from the meta-analysis by KDIGO (2013) were used to determine the average relative risk of complications for all-cause mortality, kidney failure, acute kidney injury and progressive CKD. The relative risk for all-cause mortality and adjustment to the eGFR and ACR categories reported in the NT AHKPI Information System were reported in Table 3.19 and Table 3.20. The following tables report the same information for kidney failure, acute kidney injury and progressive CKD.

Kidney failure

Table A.1: Relative risk of kidney failure by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<10	*10-30*	*30-300*	*>=300*
>105	1	1	7.8	18
90-105	1	1	11	20
75-90	1	1	3.8	48
60-75	1	1	7.4	67
45-60	5.2	22	40	147
30-45	56	74	294	763
15-30	433	1044	1056	2286
<15	NR	NR	NR	NR

Source: KDIGO (2013).

Table A.2: Adjusted relative risk of kidney failure by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	1.0	1.0	7.5	38.3
45-60	5.2	22.0	40.0	147.0
15-45	244.5	559.0	675.0	1,524.5
<15	244.5	559.0	675.0	1,524.5

Source: Adapted from KDIGO (2013).

Acute kidney injury

Table A.3: Relative risk of acute kidney injury by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<10	*10-30*	*30-300*	*>=300*
>105	1	1	2.7	8.4
90-105	1	1	2.4	5.8
75-90	1	1	2.5	4.1
60-75	1	1	3.3	6.4
45-60	2.2	4.9	6.4	5.9
30-45	7.3	10	12	20
15-30	17	17	21	29
<15	NR	NR	NR	NR

Source: KDIGO (2013).

Table A.4: Adjusted relative risk of acute kidney injury by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	1.0	1.0	2.7	6.2
45-60	2.2	4.9	6.4	5.9
15-45	12.2	13.5	16.5	24.5
<15	12.2	13.5	16.5	24.5

Source: Adapted from KDIGO (2013).

Progressive CKD

Table A.5: Relative risk of progressive CKD by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<10	*10-30*	*30-300*	*>=300*
>105	1	1	0.4	3
90-105	1	1	0.9	3.3
75-90	1	1	1.9	5
60-75	1	1	3.2	8.1
45-60	3.1	4	9.4	57
30-45	3	19	15	22
15-30	4	12	21	7.7
<15	NR	NR	NR	NR

Source: KDIGO (2013).

Table A.6: Adjusted relative risk of progressive CKD by eGFR and ACR

eGFR (mL/min/1.73m^2)	ACR (mg/mmol)			
	<3	*3-30*	*30-300*	*>=300*
>60	1.0	1.0	1.6	4.9
45-60	3.1	4.0	9.4	57.0
15-45	3.5	15.5	18.0	14.9
<15	3.5	15.5	18.0	14.9

Source: Adapted from KDIGO (2013).

Appendix B: Background information on comparator organisations

This appendix provides background information on the comparator organisations, which are discussed in Chapter 6.

The **Central Australian Aboriginal Congress** is the largest Aboriginal community-controlled primary health care service in the NT and has been in operation for the past 40 years. They have a number of clinics located in and around Alice Springs as well as five other small regional health service centres which provide primary health care services to Aboriginal communities in Amoonguna, Santa Teresa, Ntaria, Wallace Rockhole, Utju and Mutitjulu. In addition to primary health care, the Alice Springs clinic provides dental care, a women's health service, a men's health service, social and emotional wellbeing services, education and childcare.

Broome Regional Aboriginal Medical Service is a part of the Kimberley Aboriginal Medical Services Council and was the first Aboriginal community-controlled health service in the Kimberley region. The Council is comprised of three other Aboriginal health care facilities in addition to Broome, and was established to provide a voice for these health care providers. The Broome service provides health care services to people living in Broome, Bidyadanga and Beagle Bay. The services they provide include child health services, women's health services, and education.

Derbarl Yerrigan Health Service has been providing health care services to the Perth region for around 40 years and was set up by the Noongar community. They have seven fixed clinics located across Perth in places such as Maddington, Mirrabooke, Midland and Baysmwater. They provide services such as dental care, child and maternal health care, eye health care, and chronic disease health care.

The **Institute of Urban and Indigenous Health** was established in 2009 and was formed after four independent community-controlled health services merged. They provide health care services to Indigenous people living in the South East Queensland region, and have 17 fixed clinics located across the region. The services offered include dental health services, child and maternal health services and preventative health programs.

Townsville Aboriginal and Torres Strait Islander Corporation for Health Services has been providing health services to people living in Townsville for over 40 years. They have two fixed centres which are located in Townsville. They offer a number of services to the people of Townsville including primary health services, community services, child protection and parenting services. As well as their other health services, they also provide home visits for those unable to attend the clinic.

The **Wurli-Wurlinjang Health Service** is located in Katherine where they deliver a wide range of health care services to the residents of Katherine and to Indigenous people who live in over 25 remote Katherine-region communities. They provide services such as eye and ear health services, family support, sexual health, training, and chronic disease management.

Mitwatj Health Aboriginal Corporation was established in 1992 and provide services to people living in the East Arnhem Region, with a base at Nhulunbuy. They have four fixed clinics which provide services to the region. The services provided include maternal health care, chronic disease management, mental health services and other community programs.

Anyinginyi Health Aboriginal Corporation was created in 1984 and services the Tennant Creek and Barkly region. They also have a mobile unit which services remote areas in the North East Barkly region. They offer services such as dental care, children's health, men's health, women's health, community programs and sports and recreation services, which includes operating a fully equipped gymnasium and running after-school programs.

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