The Brimbank Spatial Map of Physical and Social Infrastructure 2017

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Foreword

The AHPC is an independent health policy think tank. AHPC's mandate is to translate the evidence of 'what works' to improve health outcomes in Australia and help reduce the impacts of socioeconomic disadvantage on health and chronic diseases in the population.

The AHPC works to improve the connection between research and policy through programs that bring together health experts, academics, researchers and policymakers and practitioners.

The AHPC has two major programs of work:

- a national health and public policy strategy to prevent and reduce the impact of chronic diseases in the Australian population; and,
- *Growing Brimbank*, a long term, place based program translating best evidence to interventions to lift the health and education outcomes and wellbeing in the Brimbank community, in western metropolitan Melbourne.

Diseases such as cancer, mental illness, cardiovascular disease, respiratory disorders and diabetes, have major long-term impacts on individuals, their families and their communities. The burden of chronic disease in Australia threatens to overwhelm the health budget, the capacity of health services and the health workforce. Much of that burden is preventable or capable of reduction through effective, evidence-based changes to policy. Yet Australia's health policy priorities continue to focus on treating illness rather than preventing it, with investment in the prevention of chronic diseases significantly lower than the OECD average.

Preventive actions can reduce the disease burden for at-risk populations through driving healthy behaviours and healthy environments focussing on tackling the risk factors and social determinants that contribute to the burden of chronic diseases.

Public policy can and should ensure that everyone has access to the opportunities that good health and a good start in life can provide and include:

- Policy initiatives that promote a population-wide approach to preventing chronic disease
- Measuring health and education outcomes for people and communities
- New models for health-funding, services and workforce

The case for investment in prevention and early intervention is well established in international and national evidence – and that is, that identified health and education risks in communities, and in early years of the lifecycle, contribute to preventable and costly conditions in later life and can be prevented or ameliorated by early intervention both in childhood and across the life course. The return on investment outcomes include reductions over time in the social and economic impacts of preventable chronic disease on individuals, communities and the national economy. These are through both improved social participation and financial benefits in the lifetime of the Australian adult population (2008) estimated to be savings of $1.5 billion through reducing health sector costs and $0.8 billion through reducing workforce productivity losses and costs to households.

A critical component of the *Growing Brimbank* work is the development of **fit-for-purpose resources and strategies to develop local capability**: to enable better measurement and increased understanding of the risk factors for poor health and education outcomes within communities; and to develop, implement and sustain effective and efficient prevention and early intervention policy approaches and services to improve these outcomes for individuals and throughout the community. The use of these resources enables replication of these steps in similarly disadvantaged communities.

The Brimbank Spatial Map of Physical and Social Infrastructure forms part of a suite of foundation data in a trio of reports, which underpin the *Growing Brimbank* program. Uniquely, and in combination, these data now provide a comprehensive description of :

- a community's priority health and development risk factors;
- the impacts in later life on social inclusion, productivity and wellbeing ; and
- the underlying factors driving poor outcomes – socio-economic inequities, low capacity and capability to make healthy choices; and poor access to physical and social infrastructure that promote good health and wellbeing.

Together the reports provide the resources and 'tool kit' for understanding the evidence of risk factors affecting the foundations for well-being and prosperity; for identifying the best evidence of 'what works' to redress or reduce the impact of those risk factors and the leverage points; for determining best value investments and for informing policy frameworks and service models to implement and sustain change both locally and for other communities.

This report quite clearly describes how the health and wellbeing of a community is dependent on effective and linked planning of: roads, infrastructure and transport; natural and built environment; regional equity and development; and community, sustainability and resilience.

This illuminates and adds critical value to the policy and long term planning roles of local governments, state and national governments in addressing the risk factors that particularly affect health and education outcomes in communities of socioeconomic disadvantage within Australia.

We intend that this report and the suite of tools that AHPC has developed will promote debate on where and how to invest in policy directions, based on evidence, and encourage real and timely local systems change to address socio-economic inequity associated with poor health and education outcomes.

Rosemary Calder AM
Director, Australian Health Policy Collaboration

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Executive summary

This report –*The Brimbank Spatial Map of Physical and Social Infrastructure – 'The Spatial Map'* (2017) – is the third in a suite of reports that provides foundation data for the *Growing Brimbank* Program.

The Australian Health Policy Collaboration, in partnership with the Brimbank City Council, commissioned *The Brimbank Spatial Map of Physical and Social Infrastructure* (the *Spatial Map*) to profile the physical and social assets within the City of Brimbank (a municipality in the west of Melbourne) and identify the relationships between these and health and wellbeing status in the community.

A summary of the key findings is presented at the end of this Executive Summary.

Background

Physical and social assets within communities across Australia – such as health and community services, green canopy, recreation areas, childcare centres, food and alcohol outlets, sporting facilities and public transport – are significant influences on local individual and population health, development and wellbeing.

The Brimbank Atlas of Health and Education 2014 and *The Physical Activity, Sport and Health in the City of Brimbank* 2014[1] brought together a comprehensive picture of the risk factors for health and education and indicators of social disadvantage in the City of Brimbank. They were critical in identifying foci for addressing the risks and system failure points for delivering change.

This new report, the *Brimbank Spatial Map of Physical and Social Infrastructure*, adds to previous reports by specifically and purposefully recognising the importance of place and environment in determining what contributes to risk and to what extent, and the fundamental role of community assets in reducing inequity.

The combination of these three reports provides the foundation data for the development of a long-term, place-based program to lift health and education in a disadvantaged community – *Growing Brimbank* – a joint enterprise of the Australian Health Policy Collaboration (AHPC) at Victoria University and the City of Brimbank. *Growing Brimbank* is based on a capability concept for the life course. This approach[2] starts from the premise that individuals have inherent capability to attain full social and economic participation and that these capabilities can be reduced by external factors such as economic, environmental and social risk factors, as well as familial and individual risk factors.

Pathways to good health and learning outcomes are interdependent and fundamental to both individual wellbeing and society-wide prosperity. The capacity of individuals to achieve optimal health, wellbeing and prosperity is an outcome of:

- the availability of, and access to, basic goods, services and public health assets; and
- individual capabilities to make healthy choices and achieve the best possible level of functioning.[3]

Combining our understanding of the risks and indicators with the community's social and physical infrastructure is a key step forward in effectively addressing what are often seen as intractable problems.

An evaluation of the impact of evidence-based interventions in Brimbank, starting at the commencement of initiatives, will use the baseline data from the three reports and measure progress towards the 2025 targets identified in *Australia's Health Tracker 2016* and *Australia's Tracker by Area 2017*.

1 The two reports are available at https://www.vu.edu.au/australian-health-policy-collaboration/publications and were produced by AHPC in collaboration with the Public Health Information and Development Unit (PHIDU) at the University of Adelaide and the Institute of Sport, Exercise and Active Living at Victoria University respectively.
2 The capability concept is drawn from the work of international economist Dr Amartya Sen (1993).
3 Rasmussen, B. and Maharaja, N. (2015). *Brimbank health & education indicators: Conceptual foundation*. Commissioned report for AHPC. This work is informed by the work of the international economist Amartya Sen (Sen (1993). 'Capability and wellbeing', in M Nussbaum and A Sen (eds.), *The quality of life*, Clarendon Press, Oxford).

Why is it important to understand the correlations between health and wellbeing risk factors and the location of infrastructure?

Health and wellbeing are dependent on the match of resources and services to individual and community capabilities and needs. Any mismatch in where we invest our finite resources hinders the achievement of good outcomes. More often than not the investment follows tradition and assumptions rather than evidence. Without detailed information and analysis, traditions and assumptions can drive inefficiencies and ineffectiveness.

This report contributes to an understanding of how community infrastructure can support improved capacity and capability to prevent or ameliorate risks for some Brimbank residents, but not others.

The Spatial Map clearly identifies that many of the risks and indicators for reduced capability to attain good health and wellbeing have similar patterns and interrelationships and mostly correlate with disadvantage measured by the Index of Relative Socio-economic Disadvantage (IRSD). Health and education outcomes tend to be correlated and have a tendency to be "wicked problems" (Kreuter et al. 2004) – that is, hard to untangle quickly, with no single solution apparent. Policy and services therefore need to recognise the multiplicity of economic, environmental and social risk factors and their combined influence on physical and mental health and wellbeing.

The Spatial Map contains an assessment of the relationship (correlations) between health and education risk factors and the locations of infrastructure in order to identify population groups at greatest risk of low or poor access and to identify others within the community with more capacity to access such assets. These correlations and locations help establish the intervention points, community strengths and vulnerabilities, and planning needs from which to address the multifactorial issues related to health and education outcomes in a socially disadvantaged community.

The term 'risk factor' in this context is used in preference to the long-established 'social determinants of health' to underscore the existence of opportunities to build the capacity to address risk, rather than to consider some conditions and consequences as pre-determined and potentially irreversible. Risk distribution among the population identifies the inequalities within communities, which are the underlying mechanisms influencing differences in individual and groupand wellbeing.

Who should use this report?

The Spatial Map is an important tool that enables individuals and communities, and policymakers and practitioners, to:

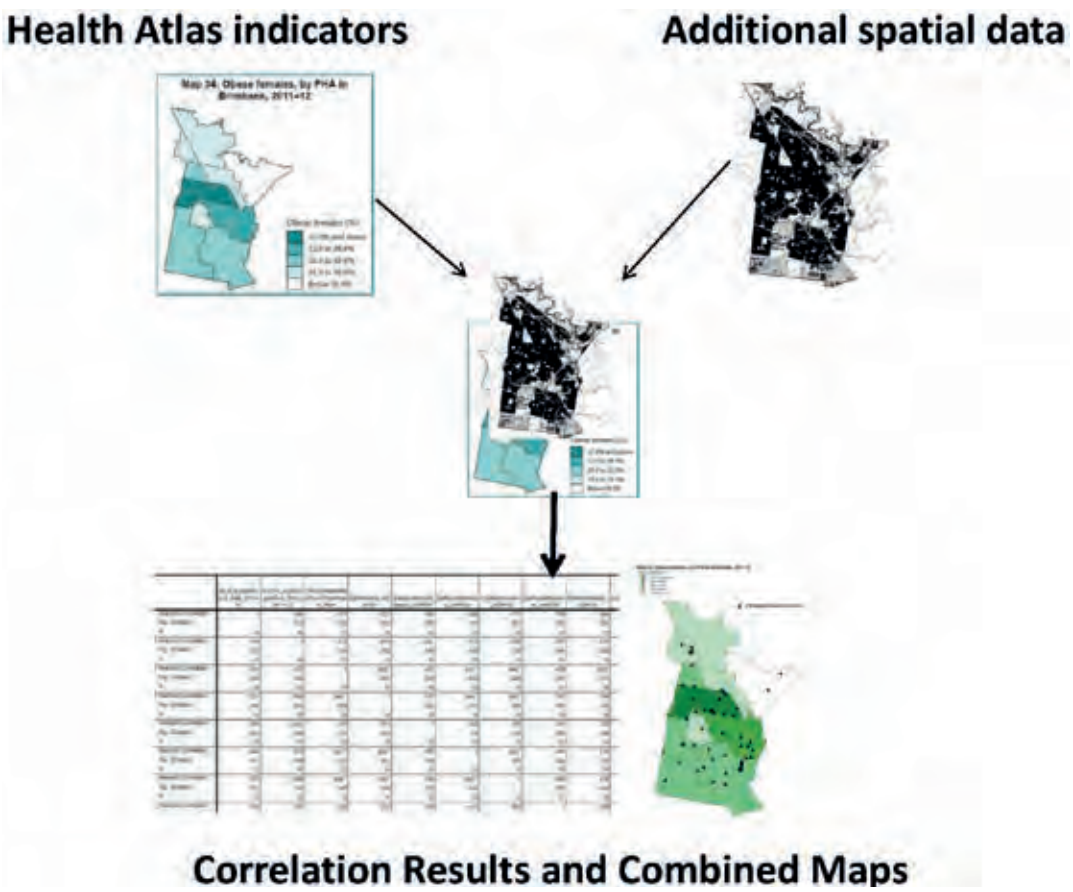
- access information about capacity and assets on which to build risk prevention and early intervention strategies and adopt a strengths-based approach to change;
- frame how and where we can achieve increased individual capability and community capacity to make healthy choices and efficiently access services for a secure and prosperous future;
- inform the design of policies, practices and cost-effective investments to improve health and education outcomes for individuals and communities; and
- understand and recognise the need for, and composition of, multidisciplinary work to connect geographical information, health outcomes, and policy around inequity in order to both influence planning and determine impact on health.

As such this suite of three foundation reports provide a tool set relevant to policymakers and change agents such as Primary Health Networks, Local Government Authorities, non-government services, and state and national governments.

Method in brief

This project was designed to identify and map Brimbank-based physical and social infrastructure that contributes to or affects the risks for individual's health and wellbeing (see Section 3, main report).

The Spatial Map combines health and education measures from *The Atlas* with a range of publicly accessible and replicable information on the social and physical features and infrastructure within Brimbank that can support individual capability and community capacity for health and wellbeing. This concept is shown in the diagram below.



Geographic Information Systems (GIS) formed a key component of the methodology. By combining the two sets of information above using GIS, the following were produced:

- maps of location and distribution of features; and
- correlation results (measurements of the strength of the relationships between features and outcomes).

Correlations **over 0.71** were flagged as significant.

As in other statistical analyses, correlation does not imply or define causation. Outputs from GIS analysis can explain *where* a factor exists and to what extent, but cannot explain *why*.

The report maps associations between the Brimbank community's infrastructure and six health and development indicators selected from *The Atlas*.

The elements of physical and social infrastructure explored were those most likely to:

- promote better health and wellbeing (such as good nutrition and social inclusion) or ameliorate risks;
- hinder or reduce good health and wellbeing (such as obesogenic environments); and
- be important for Brimbank City Council's community plan and health and wellbeing strategies.

They included:

- environmental determinants of food availability and physical activity;
- public transport;
- features related to promotion of childhood development;

- environmental features that promote wellbeing (contour variation, parklands, tree canopy);
- availability (numbers) and proximity (coverage/distribution) of a range of services and providers of food, leisure-time physical activity, and learning and development;
- community and neighbourhood supports and groups; and
- out-of-hours availability of some services.

Maps of infrastructure overlaying a health or development outcome or indicator are used to graphically identify associations between the location of different features and the geographic variations in health and education outcomes within Brimbank. The correlations are quantitative measures of these patterns, revealing the extent of association between a health outcome and a specific feature. A correlation is either:

- positive – **higher rates** of better health and development outcomes are associated with **greater access** to a feature promoting health and development; or
- negative – **higher rates** of poor health and development outcomes are associated with **less access** to a feature.

The bulk of maps and correlation results were produced at Brimbank Population Health Area level (PHA), a geographical area specifically used for Australian health data. Where possible, Melbourne-wide maps were added for context and comparison.

Supporting technical information for *The Spatial Map*, such as spatial metadata and a list of spatial data items, will be lodged on the AHPC website.

How we used GIS

Overlaying the concentration of physical and social features on the geographical distribution of health and development outcomes tells us:

- **where** patterns of presence or absence of particular features occur in association with risks to health and education; and
  - how many particular feature types are found in an area (**coverage**);
  - how close, on average, residents are to various features (**proximity**);
  - the **variation between areas**; and
  - **the strength or extent** of those associations (correlations).

Additionally, by blending features – such as fast food outlets, parks and public transport – over a specific outcome such as obesity, we built the picture that helps us describe the 'many different Brimbanks' or subpopulations and the multifactorial nature of the problem.

How to use *The Spatial Map*

Sections 2 and 3 of this report provide detail about context and methodology.

Section 4 of *The Spatial Map* (Analysing Selected Indicators), presents six key health and wellbeing indicators. These are self-assessed fair or poor health (4.1), obesity (4.2), diabetes (4.3), psychological distress reported as 'high' or 'very high' (4.4), hospitalisations for ambulatory care-sensitive conditions (ACSCs) (4.5), and children developmentally vulnerable on one or more domains in the Australian Early Development Census (AEDC) (4.6).

Each indicator has:

1. a summary box of findings and contextual data;
2. a description of the risk factor or indicator based on *The Brimbank Atlas of Health and Education* (2014);
3. correlation tables (positive and negative) and a summary
4. maps by area and subpopulations (PHA level) with overlays demonstrating the distribution of infrastructure; and
5. discussion, including literature on the topic and possible implications.

Conclusion

The Brimbank Spatial Map of Physical and Social Infrastructure reflects the interaction between social and physical environments and the health and wellbeing of individuals. This report presents maps and correlations in a narrative format in order to tell Brimbank's particular story of diversity and capacities.

The findings in this report have implications for local, state and national policies, plans and services affecting the health and wellbeing of

individuals and social and economic participation, particularly in disadvantaged communities.

Interventions for poor health and wellbeing are increasingly being developed and delivered in non-traditional settings and models (community health care services, parks, greengrocers and schools, volunteer organisations and leisure centres). These and other assets identified in this report are valuable agents for good health and community resilience.

The findings will assist the Brimbank City Council in its application of policy regulation and planning to support optimal health, development, wellbeing and education outcomes.

The analysis of the health, wellbeing and education impacts of the social and physical infrastructure identified in this report will be a further stage of work with partners to the Collaboration, underpinning the *Growing Brimbank* program.

Key findings

The findings describe both generalised patterns and patterns specific to particular risk factors.

Generalised patterns

- **There are 'many different Brimbanks'** (subpopulations) described by their community infrastructure, population density, health and education outcomes, cultural diversity and levels of socio-economic disadvantage.

  However, people living in specific geographies do not have the same characteristics (Ess and Weeks 2001).[4] In Brimbank specifically, the recognition of the diversity of strengths and wealth of cultural resources (as well as vulnerabilities and needs) is vital for the identification and leveraging of assets within communities to redress risk factors affecting the community. The social infrastructure identified within Brimbank – such as the numbers of incorporated community groups in St Albans (200) and Sunshine (115) – are indeed assets.

- **The connection between socioeconomic status (SES) and the selected health and development outcomes is recurrent and striking**.

  The pattern of correlations between poor health status and socio-economic disadvantage is repeated through the report. For example, self-assessed fair or poor health, female obesity, psychological distress and diabetes have very similar (but not identical) correlations with socio-economic disadvantage.

  People with poor health and development outcomes tend to live in areas of low socio-economic advantage where the **infrastructure** includes:

  - **more** bulk billing GPs, dentists and pharmacies;
  - **more** flexible learning centres (tailored programs for disadvantaged young people);
  - **greater numbers** of, and proximity to;
    - takeaway or fast food outlets (compared to access to major supermarkets and shops selling fruit, a proxy for fresh food availability);
    - packaged liquor licenses;
    - licensed clubs and poker machines;
  - **fewer** playgrounds, pets, indoor play centres, trees per person, conservation zones, drinking fountains and bike trails, and women's gyms;
  - **less** residential proximity to walking school bus stops; and
  - **more** cultural supermarkets.

Clearly, some support services move to where the 'needs' are, but others do not. Some commercial services are more densely distributed in community areas with lower socio-economic status.

- **There is a consistent pattern of distribution of poor outcomes** (such as self-reported poor health, female obesity, diabetes, psychological distress, men smoking and children who are developmentally vulnerable) in a band across the PHAs of Sunshine, St Albans and Kings Park in Brimbank (see collated maps at end

4 The 'ecological fallacy' when area-based indices of disadvantage/advantage are applied to schooling in Australia; overall outcomes for children depend far more on subtle interplays between individual, family and community factors and macro conditions- Some children from poorer communities go on to have positive outcomes.

of this section). Equally, the features (or their absence) known to be associated with poor outcomes appear to be more prevalent in this band of entrenched disadvantage.

- **Some comparisons are more informative when made to Greater Melbourne or Victoria, rather than with subpopulations in Brimbank.**
  - **Some features are so pervasive** in the community that there is not sufficient variation *within* Brimbank to show any correlation between the infrastructure or feature and health and development outcomes. However, this lack of correlation does not mean that the features should be ignored when planning for better outcomes. Examples are:
    - the distribution of poker machines and liquor licenses is uniform across Brimbank, and thus cannot be identified as significantly correlated with specific health risks. However, **their coverage and proximity to other community characteristics** need to be understood for planning purposes; and
    - while healthy food choices are relatively available in some parts of Brimbank, takeaway fast food stores are ubiquitous throughout the community.
  - By comparing the distribution of poker machines, liquor licences and takeaway fast food stores in Brimbank with those in Greater Melbourne, it is clear that there are strong correlations between the prevalences of these outlets and poorer health outcomes.
- **Some generalised assets within Brimbank are:**
  - the even distribution of Brimbank City Council facilities contributing to health and wellbeing (libraries, maternal and child health centres, leisure centres, playgrounds and sports fields);
  - presence of fresh food outlets, cultural and major supermarkets (although major supermarkets are less prevalent in St Albans);
  - no obvious shortages in access to primary health care providers, and a high number of general practitioners located in the most socioeconomically disadvantaged areas of Brimbank; plus
  - areas with high health and education needs in Brimbank tend to have many community groups, kindergartens, and schools provided by a mix of government and not–for-profit organisations.

Specific patterns

1. The 'many different Brimbanks' can be characterised by their IRSD scores.

Brimbank overall	926
Keilor PHA	1055
Ardeer and Sunshine West PHAs	882
St Albans / Sunshine North	839

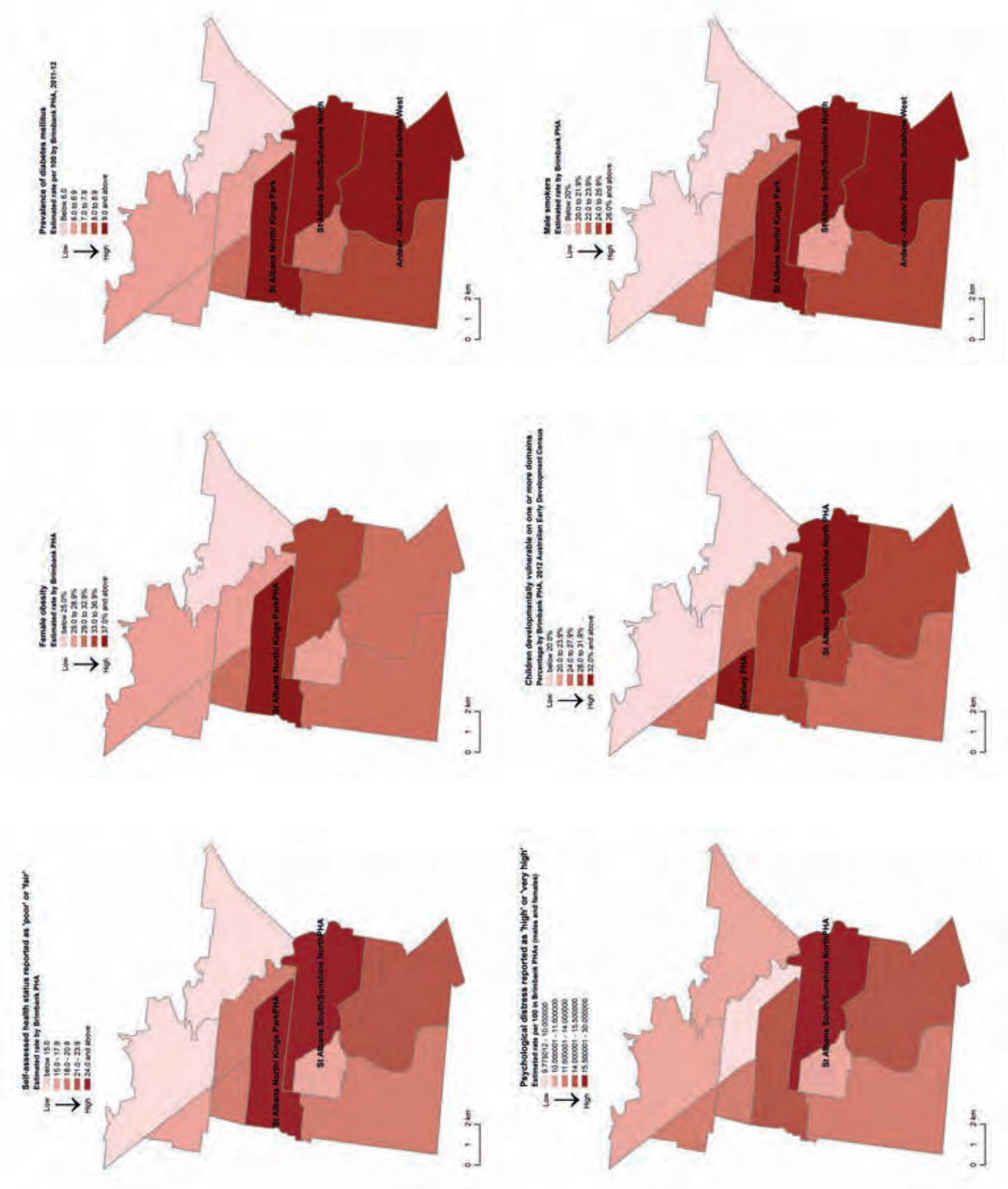
2. **Five of the six health indicators assessed** – self-assessed fair or poor health, obesity, diabetes, psychological distress reported as 'high' or 'very high', children developmentally vulnerable on one or more domains in the Australian Early Development Census (AEDC) – **are all strongly correlated** with each other, and with:
   - health risks such as harmful use of alcohol and male smoking;
   - contextual indicators of low SES such as;
     - children living in jobless families;
     - mothers with low educational attainment;
     - adult unemployment;
     - people aged 15 years and over living with a disability;
     - no internet connection at home;
     - low-income households under financial stress; and
     - low-income households with children developmentally vulnerable in one or more domains of the AEDC.
3. **Ambulatory Care Sensitive Conditions (ACSCs) can be a good litmus test of access to early intervention, and were not a part of the above pattern.**

   Measuring admissions to hospitals for ACSCs can be used as a way of understanding whether primary health care is working optimally to prevent deteriorations of conditions which should be avoidable. Keilor, Keilor Downs and Taylors Lakes PHAs have high rates of hospitalisation for ACSCs, such as dental caries

and asthma in 0–15-year-olds and cardio-respiratory and diabetic conditions in adults, and are areas which enjoy relatively better socio-economic circumstances (higher IRSD). There are fewer GP services with late opening hours per capita in areas where higher rates of hospitalisation occur, such as Keilor compared to St Albans and Sunshine, but for both adults and children the association with late-opening GPs was weak to moderate.

4. **Natural assets** are concentrated in the relatively advantaged areas of Brimbank, such as Taylors Lakes and Keilor Downs. There is greater access (a positive correlation) to features like open spaces with trees, bike paths, drinking fountains and parkland area conservation zones, tree canopy, playgrounds and bike and walking trails associated with better health outcomes.
5. **Sports facilities and courts** are much more highly concentrated in the PHA of Keilor than in Delahey and Cairnlea, PHAs closer to the 'band' of disadvantage previously identified.
6. **Some PHAs and suburbs** with poor health and education outcomes **stand out** in relation to:
    - fewer neighbourhood groups. There are fewer neighbourhood groups **in Sunshine**, which has a high proportion of children who are developmentally vulnerable in terms of their social competence, emotional maturity and/or communication upon entry into school;
    - residences with greater proximity to packaged liquor licenses and fewer gyms. **St Albans** and **Kings Park** have many packaged liquor licenses and fewer gyms and the highest estimated rates of obesity in women; and
    - fewer GP services with late opening hours per capita. As previously noted **Keilor, Keilor Park** and **Taylors Lakes PHAs** have higher rates of hospitalisation for ACSCs, particularly in 0–14-year-old children, and relatively less access to GP services with late opening hours.
7. Where there are **higher rates** of poor health and development outcomes (**Sunshine West and North, St Albans,** and **Kings Park**), we see **less access** to features (**negative correlations**) such as:
    - public and commercial physical activity / fitness centres / gyms;
    - walking to school bus stops; and
    - contour variation; and public toilets.
8. **High volume roads** and train lines divide sections of Brimbank and potentially influence the health care that residents can access. Such correlations give rise to questions to be explored; examples are whether 'very high volume traffic' within Keilor is related to ACSCs, and whether poor access to the nearest Leisure Centre for residents of Kings Park and Delahey PHAs drives the high rates of female obesity.
9. **Privately run services** like gyms (especially women's gyms), swim schools and children's indoor play centres are significantly less prevalent in the more disadvantaged areas of Brimbank such as St Albans and Delahey, where there are higher rates of female obesity, poor self-assessed health and childhood developmental vulnerability.
10. **Bottle shops** are significantly more prevalent in the more disadvantaged areas of Sunshine, St Albans and Kings Park.

Collated maps showing the geographical band of distribution of higher rates of poor health outcomes and risk in Brimbank



Section 1: Context and purpose

1.1 Purpose

This report – *The Spatial Map of Physical and Social Infrastructure* – commissioned by the Australian Health Policy Collaboration (AHPC) presents an innovative approach to existing data on health and wellbeing for a geographically defined community.

The report is focused on the City of Brimbank in the western metropolitan region of Melbourne. It examines the relationship between significant social and physical infrastructure assets in the Brimbank community and measures of poor health and education outcomes or risks for poor health and education outcomes in the community.

The City of Brimbank and the AHPC have established the Brimbank Collaboration, a joint commitment to a long-term, place-based program applying evidence-based interventions to address risk factors for poor health and wellbeing in a community with significant levels of socioeconomic disadvantage.

The City of Brimbank is a large local government area (LGA). It is culturally diverse, with residents speaking more than 150 different languages, about 43% of the population born overseas, and more than half the population speaking a language other than English.

The LGA reflects the myriad of policy issues and barriers associated with a rapidly growing region undergoing substantial economic and social change.

Two foundation reports for the Collaboration were published in 2014:

- *The Brimbank Atlas of Health and Education*, and
- *Physical Activity, Sport and Health Report for the City of Brimbank.*

They identify risks and indicators of health, education and wellbeing in the Brimbank community and their impact.

This report is the third foundation report for the Collaboration. It demonstrates the ways in which health and other social data can be augmented with a geographical approach, and specifically the use of Geographic Information Systems (GIS).

This approach is critical to identifying the profound impact of the environments in which people live on their health and wellbeing, and the fundamental role of community assets in reducing inequity.

The key outputs presented in the report are maps and correlations representing the strength of relationships between health outcomes for residents of Brimbank and a range of assets within the City of Brimbank that constitute the everyday environment for its residents – from schools to transport options, libraries, food outlets and health care providers.

Not all features of Brimbank are included, but many different features are combined into the maps and correlation tables. The patterns in these features can help to inform thinking on questions like: *Does poor health relate to poor physical access to health care providers in Brimbank? Does obesity relate to a lack of local healthy food options?*

The maps and correlations do *not* present answers, but they can help present new perspectives on public health challenges. Many public health issues are, on the one hand, complex and multifaceted, but on the other hand, geographically stark: irrespective of the complexity of overlapping factors, rates of health indicators like diabetes, obesity, hospitalisations for ambulatory care-sensitive conditions (ACSCs – conditions that could be expected to be well managed with primary or community-based care, thus avoiding unnecessary hospitalisations), and psychological distress are higher in Brimbank than in many other parts of Melbourne.

Recognising this, the *Brimbank Atlas of Health and Education* was specifically designed to support a ***place-based approach***. This is based on the observation that:

> *… there is a clear association between the health and wellbeing of individuals and communities, and where they live. Place can influence health and wellbeing, both positively and negatively, directly and indirectly. (The Brimbank Atlas, page 6)*

A place-based (ie. geographical) approach has already brought new insights to many areas of public health (Australian Institute of Health and Welfare 2011, Christian et al. 2015, Cummins et al. 2007, Dorling 2013, Jones et al. 2007, Lakerveld et al. 2016, Moodie & Taylor 2012).

Some researchers describe the different perspective that geography can bring to public health as the "public health macroscope" (Rydin et al. 2012). This refers to the fact that many health issues are not adequately studied under a microscope alone or by a focus on a subset of affected individuals. There is a risk of losing sight of a true understanding of the subject if we ignore patterns that interact with genetics and individual behaviours. A prominent example is the current obesity trend; the rapid growth and uneven distribution of this chronic health problem is difficult to understand through a focus on individuals.

In addition, the overlay of maps, featuring different spatial aspects, provides an increasingly probing and informative picture. For example, a map of hospitalisations for ACSCs indicates high rates in Taylors Lakes and Keilor. When the features of high-volume traffic, distribution of bulk-billing GP surgeries, pharmacies and dentists, and late-opening GP surgeries are overlaid, the relationships between these infrastructure assets and the hospitalisation data (the correlations) suggest they contribute to the high rates.

GIS is noted for its ability to bring together many different data sources at multiple levels (including the 'macrosope'). The use of GIS in this report is intended to:

- identify information that individual data, in itself, does not provide;
- augment an understanding of health and wellbeing outcomes in Brimbank;
- highlight potential connections between features and assets in the local environment contributing to health and wellbeing outcomes in Brimbank; and
- contribute to policy information and interpretation of the relationship between health and wellbeing outcomes and community environments and assets.

GIS can act as a "glue" or "catalyst" in multidisciplinary research (Knigge & Cope 2006, Brown & Knopp 2008). A multidisciplinary, collaborative and policy-focused approach to public health has been advocated in recent Australian research:

> *Multidisciplinary research teams … can close the gap between researchers and policymakers by increasing the policy relevance of the research …[and] increase attention to health in decision-making about the built environment. (Giles-Corti et al. 2015)*

This report is intended to be useful to urban planners, for systems and logistics planning, as well as for social and health services provision and planning.

It contributes to a comprehensive profile of the health and wellbeing of the community of Brimbank, and the potential relationships between health and wellbeing and community physical and social infrastructure.

For policymakers, as well as health and community service providers working in communities such as Brimbank, targeted information on distribution of supply and patterns of access and demand related to socio-economic and environmental factors that affect health and wellbeing is critical.

The Australian Health Policy Collaboration

AHPC is a policy translation think tank that aims to inform and influence health and public policy nationally and locally, through the application of evidence about 'what works' to address specific risk factors for poor health and education in communities with significant socioeconomic disadvantage.

AHPC does this through two integrated programs:

11. a research translation program to inform and influence policies to prevent and reduce the impact of chronic diseases on the health and wellbeing of the Australian population
12. the Brimbank Collaboration, a community observatory focused on the risk factors within communities that affect the health and wellbeing of individuals, and particularly the development of preventable chronic diseases.

1.2 Background: *The Brimbank Atlas of Health and Education*

The Brimbank Atlas of Health and Education was prepared in 2014 by the Public Health Information Development Unit (PHIDU).

The Atlas is a compilation of nationally accessible and consistent data on a range of health, wellbeing and education outcome risks and indicators of socio-economic disadvantage within the City of Brimbank.

It brings together health, wellbeing and education data relevant to Brimbank from a range of sources, and presents them as comparative tables, small maps, and correlation results, interwoven into separate thematic discussions (Figures 1 and 2).

This report complements the Atlas, and responds to some of the significant patterns of health and wellbeing of individuals within Brimbank highlighted in it.

Data in the Atlas were drawn from a variety of national collections, particularly the *2010 General Social Survey* (Australian Bureau of Statistics (ABS) 2011), the *2011 Census of Population and Housing* (ABS 2012) and the *Australian Health Survey 2011–12* (ABS 2012).

Data for this report were drawn from the Atlas (see Figure 1.1) and additional spatial datasets that are not specifically about health or wellbeing but describe assets and deficits in Brimbank.

The process of combining the health, wellbeing and social data (*The Brimbank Atlas*, 2014) with geographical, social and physical infrastructure information (the spatial data sets) allows the reader to:

- visually identify areas of concentration of risks and variations in access to resources, in association with poorer health and wellbeing outcomes; and
- assist in developing questions and/or answers about why these outcomes exist by overlaying the distribution and concentration of several assets, thus 'building the picture'. It is often the overlay of additional features or characteristics that reveals potential explanations, not considered at first review of the data.

Figure 1.2 Illustrates this process, which is detailed further in Chapter 2.

People living with disability

The likelihood of living with disability increases with age. The disability rate among 15 to 24 year olds was 6.6%, and the rate was higher for successively older age groups, with 18% of 45 to 54 year olds, and 31% of 55 to 64 year olds living with disability in 2009.[1] In Victoria in 2006, there were nearly 5,000 parents aged 65 years and older who were living with a son or daughter with a more severe disability.[2]

Personal networks for people with profound or severe disability are particularly important in supporting their integration into the wider community, thereby enhancing their wellbeing and the social fabric of the community. In 2009, in terms of disability group, people with intellectual disability who had profound or severe disability, were less likely to have participated in social clubs and organisations in the previous 12 months than their counterparts who reported other disability types.[3] However, all people with disability were less likely to have participated in social and support groups than people without disability.[3]

Indicator definition: Comprises people living in the community who reported in the 2011 Census a need for assistance which resulted in them being designated as having a profound or severe disability. These 'living in the community' data exclude people living in long-term residential accommodation in nursing homes, in accommodation for the retired or aged (not self-contained), in hostels for the disabled, or in psychiatric hospitals.

Key points

- Almost 730 children aged 0 to 14 years were living with disability in Brimbank.
- Brimbank has a substantially higher rate of people aged 15 years and over living with a disability than the Australian average.

Geographic variation

0 to 14 years of age

Children aged 0 to 14 years and living with disability comprised 2.1% of all children aged 0 to 14 years in Brimbank at the 2011 Census (Table 41). This proportion is consistent with the Melbourne and Australian averages (1.9% and 2.0% respectively).

Of the SLAs, Sunshine had a higher proportion than Keilor, at 2.2% and 2.0% respectively.

As a result, almost 730 children in Brimbank aged 0 to 14 years were estimated to be living with disability at the 2011 Census.

Table 41: Children aged 0 to 14 years living with disability, Brimbank and comparators, 2011

Region	No.	%	RR#
Brimbank - Keilor	**328**	**2.0**	**1.00**
Brimbank - Sunshine	**400**	**2.2**	**1.08**
Brimbank City	**728**	**2.1**	**1.05**
Melbourne - West	2,702	2.1	1.05
Melbourne	14,146	1.9	0.96
Country Victoria	6,431	2.5	1.24
Victoria	20,577	2.1	1.03
Australia	**83,154**	**2.0**	**1.00**

#RR is the ratio of the percentage in the area to the percentage for Australia

Higher proportions of children living with disability were recorded in the PHAs of St Albans - North/ Kings Park and Sydenham (2.4%), followed by Deer Park - Derrimut (2.3%). In contrast, lower proportions were recorded in Keilor, St Albans - South/ Sunshine North and Taylors Lakes (1.8%) (Map 20 and Table 42).

Map 20: Children aged 0 to 14 years living with disability, by PHA in Brimbank, 2011

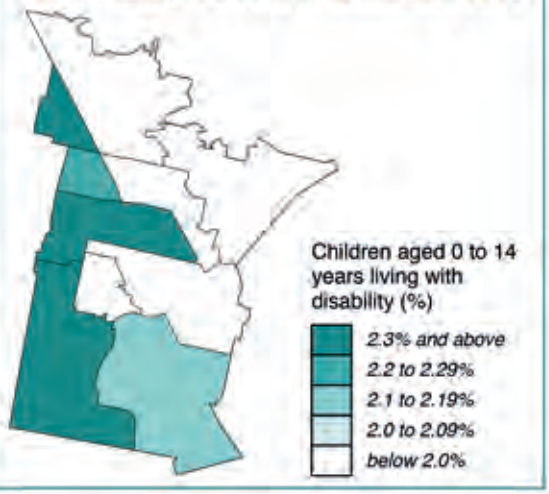


Figure 1.1 Example page from *The Brimbank Atlas of Health and Education*

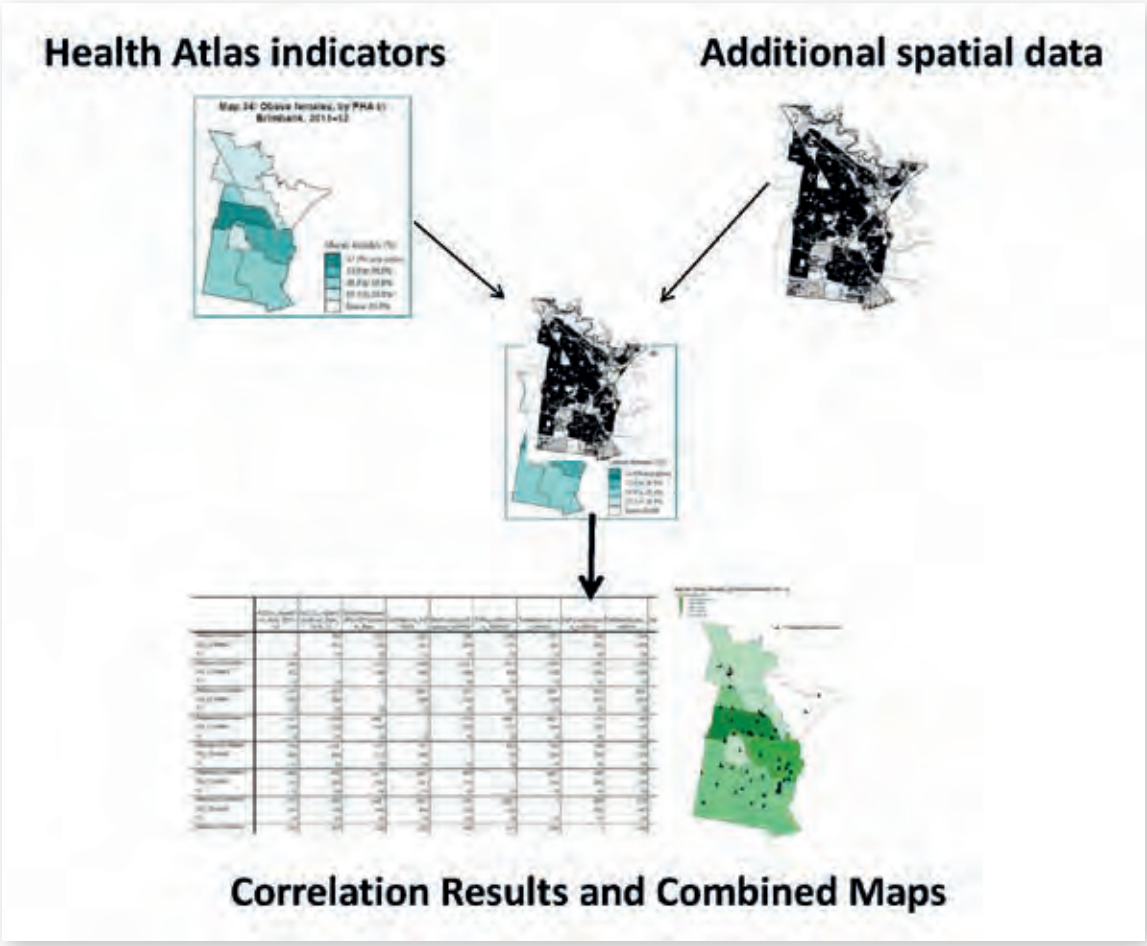


Figure1.2 Overview of methodology

The data in *The Brimbank Atlas of Health and Education* was divided into two groups of **indicators** (summary measures of chosen events derived from data collections that record all cases or a representative sample of the events in a population).

These two groups are:

1. **Contextual indicators**

   For example, labour force participation, English proficiency, housing stress, socio-economic disadvantage, and the percentage of children under 15 years of age living in families where no parent has a job.[5]

   Most of these indicators are derived from the 2011 Census of Population and Housing.

2. **Direct indicators of health and wellbeing, and education outcomes and child development**

   For example, low-birthweight babies, hospitalisations for ACSCs, obesity, early school leavers, children developmentally on track.

The direct indicators in *The Brimbank Atlas of Health and Education* were compiled from multiple primary sources, including the Australian Early Development Census (a periodic survey of school readiness for all first year students), Victorian Department of Health hospital admissions data, and the 2011–13 Australian Health Survey and 2010 General Social Survey conducted by the Australian Bureau of Statistics.

On some indicators, Brimbank data stand out when compared to Melbourne or Australia. For example, Brimbank has high estimated rates of female obesity and hospitalisations for ACSCs when compared to Melbourne and Australia. Some but not all of these indicators are also differentiated within Brimbank, with some Population Health Areas (PHAs) within Brimbank showing very different rates to others.

5 *The Brimbank Atlas of Health and Education* (2014), p. 47

For example, the rates of psychological distress for males differ in Sunshine (13.2 per 100 population), Keilor (10.7 per 100) and Brimbank overall (12.0 per 100), although all exceed national rates.

This *Spatial Map* focuses on health and wellbeing indicators that show marked differences between Brimbank and Australian averages, as well as strong differentiation within Brimbank. Through the use of GIS, the investigation sought to discover:

- where health and wellbeing factors vary within Brimbank, and the connections to other factors and influences; and
- the relationships between health and wellbeing variations and availability of local assets that support health and wellbeing.

1.3 Geographic Information Systems (GIS) and its relevance to health research

Geographic Information Systems are a combination of geographic data and information systems. The term **GIS** is most often used to refer to the use of particular software packages that enable the combination of table data with map data (see image below). However, GIS is not a software-specific research tool.

Spatial data – the core of GIS – refers to any data that can be represented on a map. This includes many features of everyday life and the environment, such as addresses, flora and fauna, and population data from different suburbs, states, or countries.

In practice, use of GIS has traditionally been concentrated in particular research areas such as environmental science, transport, urban planning and demographic modelling. Use of GIS in less traditional research areas has expanded since the early 2000s (Gibson et al. 2010, Kwan 2002). This is due in part to decreasing costs of GIS software, which in the 1980s and 1990s were affordable only to large organizations and the military, and also to the "spatial turn"(Withers 2009), a term for researchers in diverse fields integrating location in their work.

GIS can augment and inform new research by being an effective communication tool, a way to bring together different data sources, and a way to understand underlying processes better.

Since power is often spatially mediated and reinforced – through property boundaries, legal jurisdictions, access to public and private space and so forth – integrating location can add much to social research (Massey 2005).

Health is one of the research areas in which GIS has found many more applications since the early 2000s (Barton & Grant 2006, Cummins et al. 2007, Dorling 2013, Geraghty et al. 2010).

This report, together with *The Brimbank Atlas of Health and Education* (2014), enables a deeper understanding of opportunities for risk mitigation, community development and enhancement. Together these reports provide a platform from which to direct further exploration and research, to inform planning principles addressing equity, and to inform policy and practice strategies and services.

The 'health map' diagram below (Barton & Grant 2006) is one of numerous frameworks that conceptualise health as a set of overlapping factors. Such frameworks are naturally complex, but they move beyond single-issue health responses and are suited to understanding 21st-century chronic health problems, to which a 'macroscope' can add as much as a microscope or a specific health service response.

Figure 1.3 The health map (Barton & Grant 2010)

The health map represents the concept that many factors influence health and wellbeing: age, sex and hereditary factors play a role, but not in isolation from the wider environment.

Factors that can affect health outcomes operate at different scales. It is important, therefore, to acknowledge that local community influences on health and wellbeing are a part but not the whole picture of the influences that can promote or inhibit good health and wellbeing in individuals. Other influences operate nationally, regionally and within specific community groups.

The purpose of Figure 1.3 is to illustrate the role of working across and within Brimbank and its communities to lift health and education outcomes, where natural and built environments, daily activities, the economy, lifestyle and the needs and aspirations of its population are all critical contributors.

What can Geographic Information Systems tell us?

Data from GIS can help to highlight patterns that would be extremely difficult to reveal with other data forms. This can give a 'forest through the trees' perspective, highlighting connections between datasets. Alternatively, data from GIS can demonstrate that there is no apparent spatial pattern; this is informative in itself.

Maps can be a very efficient means of conveying complex information. Spatial statistics (numbers generated from maps) make it possible to test the probability of a particular spatial distribution occurring by chance.

What can Geographic Information Systems not tell us?

Data from GIS can provide clues to underlying processes by highlighting ***where*** patterns occur, but they cannot explain ***why.***

GIS statistics can indicate correlation, not causality. Used well, GIS data are a stepping stone to further inquiry or research, rather than the end point (Chrisman 2005, Gordon 2011, Kwan 2002).

Particular challenges apply to using GIS in health research. This is explained in more detail in the Method section, Appendix A.

1.4 Comparable studies

In health research, GIS typically forms part of an interdisciplinary approach. This is because, firstly, GIS was not developed as a health research tool, and secondly, GIS is noted for its ability to bring together multiple data sources that have location in common (Brown & Knopp 2008, Knigge & Cope 2009).

While GIS is not a standard tool in health research, its use is growing. For example, in April 2016 the Association of American Geographers hosted a four-day seminar on GIS and related technologies in health research, referred to as a "frontier".[6]

Sessions covered a wide range of GIS applications in health, including:

- spatial approaches to improving maternal and child health;
- urban temperatures and shade provision;
- socio-economic status and urban health;
- healthcare services: access and participation;
- measures of spatial access to urban green spaces; and
- spatial statistics and disease mapping.

These diverse health topics were brought together through geography – asking "where?" to better understand "why?" in health measurement and research.

More evidence of how use of GIS in health has grown comes from the journal *Health & Place*,[7] established in 1995 as "an interdisciplinary journal dedicated to the study of all aspects of health and health care in which place or location matters". Recent article titles include:

- The interplay between neighbourhood characteristics: The health impact of changes in social cohesion, disorder and unsafety feelings;
- Natural and built environmental exposures on children's active school travel: A Dutch global positioning system-based cross-sectional study;
- Changing spatial patterns and increasing rurality of HIV prevalence in the Democratic Republic of the Congo between 2007 and 2013; and
- Rural tobacco use across the United States: How rural and urban areas differ, broken down by census regions and divisions.

GIS in health research is not an entirely new phenomenon: John Snow's famous resolution of a cholera outbreak in 1854 relied on geographic information in much the same way as researchers today, albeit without computers. In this case, maps gave new perspective on *where* health problems were occurring (cholera deaths near particular water pumps), but it was up to researchers to analyse *why* these spatial patterns were occurring (sewage-contaminated drinking water).

Physical proximity to a source of infection is a fairly obvious spatial contributor to disease. The extension of GIS to *chronic disease* management is relatively new, but much in demand due to the prominence of chronic diseases in 21st century industrialised nations (Moodie et al. 2016).

For example, some researchers have sought to use it to improve understanding of the social and environmental drivers of diabetes (Curtis & Lee 2010, Geraghty et al. 2010, Kruger et al. 2008, Ranta & Penttinen 2000) and the complex set of factors that determines access to health services (Hiscock et al. 2008, Todd et al. 2015).

English geographer Danny Dorling is a high-profile proponent of melding public health and geography. In Dorling's case, linking health to

6 www.aag.org/cs/AM2013/GIS-Frontier
7 www.journals.elsevier.com/health-and-place/

geography is also related to economic trends; he emphasises the links between health, spatial disparity, and widening economic gaps (Dorling 2009, 2013).

This *Spatial Map* presents results that are comparable to, and complement, *The Brimbank Atlas*. The data presented in the Atlas was drawn from national data collections, primarily between 2011 and 2012.[8] This report then combines data drawn from a range of Brimbank, Victorian and national data collections from more recent collections up to 2015.

The data are therefore not necessarily consistent over time, although the intervals between collections are not substantial. The *Spatial Map* combines different pieces of information for common locations and outputs maps and correlations. It combines a variety of datasets that are not necessarily health-related but illustrate, and sometimes illuminate, the geographical patterns of risk factors and health, wellbeing and education outcomes within the Brimbank community.

1.5 More on the importance of the overlay of infrastructure

As previously stated, it is not sufficient to study health issues on their own or by a focus on a subset of affected individuals.

Understanding the patterns of health and wellbeing of individuals and of communities requires more than attention to measures of individual and community health and wellbeing, as poor health and wellbeing and good health and wellbeing have been shown to cluster in communities of socioeconomic and other advantage and disadvantage.

This report considers the physical and social infrastructure within the community of Brimbank that show patterns of relationship with the patterns of health and wellbeing within Brimbank, and within the smaller geographical communities that comprise the City of Brimbank.

This report demonstrates the process of using GIS software to **overlay** the concentration and distribution of physical and social features on the geographical distribution of the risk factors to health and wellbeing that are significant in the Brimbank community.

By blending map features, we measure:

- how many of a particular feature type are found in an area; and
- how close (on average) residents are to various features.

This literally allows us to '**build the picture**'.

Let's take the example of this report's sixth risk factor – **developmentally vulnerable children**. **St Albans/Sunshine Nth and Delahey** PHAs have larger numbers of the most vulnerable children are in Brimbank (Map 4.6.2) compared to Melbourne **Population Health Areas** (PHAs) (Map 4.61).

Thus, the focus of this section is to explore the contribution of environment, geography and topography to the vulnerability of children; physical and social infrastructure assets that have strong correlations with health risks are identified through the mapping of both together (overlaying).

To explore the contribution of environment, geography and topography to the risk factor in our target areas, the following factors with strong correlations are overlaid:

Map 2.4 page 31 –tells us that our target area of St Albans PHA has some industrial areas in close proximity to the dense residential areas.

The GIS information tells us about the relationship of access to important assets in childhood development and childhood vulnerability.
For example:

- kindergartens and preschools (**Map 4.6.3**); and
- playgrounds and flagship parks (**Map 4.6.6**)

are less prevalent in two PHAs (St Albans/Sunshine and Delahey) than in other PHAs in the Brimbank local government area.

However, Brimbank Maternal and Child Health Centres appear to be well placed in these two PHAs and evenly placed throughout Brimbank (**Map 4.6.4**)

8 Available on the PHIDU website: http://phidu.torrens.edu.au/

Within easy travel distance from our target PHAs, there are no :

- libraries or toy libraries (**Map 4.6.5**) ; or
- indoor play centres (**Map 4.6.8**) and private swim schools and aquatic centres (**Map 4.6.9**).

Late-opening GP surgeries (**Map 4.5.7**) on the border between St Albans North and Delahey or Keilor and St Albans and Sunshine are available, but by no means numerous.

For any of these childhood services, access may be hampered because of:

- the density and intersections of main arterial roads and accident black spots (**Maps 4.6.11**, **4.5.6**);
    - lack of alternative options to public transport such as 'walking school bus stops' (see section 2, Map 2.5); and
    - relatively few off-road bike paths (**Map 4.6.12**) leading to the few playgrounds (**Map 4.6.6**) in our target areas, compared to other PHAs.

The strong inverse correlations with conservation zones / parkland / trees per person / contour variations are starkly revealed in these two PHAs by maps:

- 4.5.3, where low elevation topography is evident;
- 4.2.10, showing relatively little parkland in either PHA; and
- 4.1.4, showing poor distribution of trees (public space and street) in Sunshine North and half of Delahey.

There is relatively good access to primary schools in St Albans but less access in Delahey PHA (**Map 4.6.7**).

However, more disturbingly, the positive correlation of packaged liquor licenses to childhood vulnerability (.947**) is strong, as demonstrated by their even and frequent distribution in these two PHAs, as well as the rest of Brimbank. Packaged liquor licenses are relatively nearby to schools in St Albans (**Map 4.6.10**).

Flexible Learning Centres (**Map 4.4.5**) appear to be well placed within St Albans, in proximity to an area of high childhood vulnerability.

This suite of reports is the foundation to *Growing Brimbank*:

- *The Brimbank Atlas of Health and Education* 2014, Public Health Information Development Unit (PHIDU)
- *Physical Activity, Sport and Health in the City of Brimbank* (2014), the Institute of Sport, Exercise and Active Living, Victoria University
- *The Brimbank Spatial Map of Social and Physical Infrastructure* (2017), Sarah Taylor, commissioned by AHPC.

Section 2: Brimbank in context

This chapter provides a brief introduction to the City of Brimbank.

Brimbank is large: the City of Brimbank was established in 1994 after the merger of the former Cities of Keilor and Sunshine; it spans 123 km² and had an estimated population of 199,432 in June 2015.

Brimbank comprises 25 new and established suburbs. Much of the recent residential growth has been in Delahey, Sydenham, Taylors Lakes, and more recently in Cairnlea.

In recent years the highest growth of population occurred in 2009, declining marginally each year since. It is the second most populous municipality in metropolitan Melbourne (after Wyndham, the largest in the Western Region), and incorporates one of the largest industrial areas in Melbourne.

Brimbank is relatively disadvantaged: the City of Brimbank scored 925.8 on the index of socio-economic disadvantage (IRSD), making it one of the 10 most disadvantaged capital city LGAs in Australia. The most disadvantaged communities are in central and southern parts of Brimbank, and the most populous suburbs are St Albans (IRSD = 839), Sunshine (894), followed by Keilor Downs (961).

Brimbank is culturally diverse: about 42% of Brimbank's population were born overseas (of which about 7.1% are recent arrivals – more than twice the Australian average); more than half the population speak a language other than English, and more than 150 languages are spoken. Recent migrant and refugee arrivals (since 2007) from countries in which English is not the predominant language are not a homogenous group; the most rapidly growing groups are from Asia and Africa. Close to one in every 11 people in Sunshine is either a recent migrant or refugee, with the main countries of birth being Vietnam (13.4%), India (4.2%), Philippines (3.4%) and Malta (3.1%). Some cultural groups are well established, reflected in the composition of high street small businesses and longstanding community groups (eg. the Vietnamese Women's Group).

Brimbank has experienced rapid growth and substantial economic and social change: substantial migration into Brimbank has occurred in phases, after WWII and again in the 1970s and 80s, but there has been relatively low investment in infrastructure to meet these challenges to ensure a thriving community. Migration out of Brimbank is also substantial: 41% of residents moved out of the City between 2006 and 2011.

There is a high proportion of jobless families in the City of Brimbank – twice the Melbourne average. As a result, government support is the main source of income for almost twice as many families in the City of Brimbank as in Melbourne and Australia overall. Manufacturing is the largest employer, accounting for 12,661 local jobs in 2014/15. In 2011, 34.3% of the workforce lived and worked in Brimbank. The percentage of employed citizens in the population rose from 39.3% in 2011 to 45% in 2015 (.id Social Atlas for Brimbank at http://atlas.id.com.au/brimbank).

Brimbank is home to major institutions, including Sunshine Hospital and Victoria University's St Albans and Sunshine campuses.

Many resources describe the characteristics of Brimbank:

- resources on The Brimbank City Council website;[9]
- the .id social atlas portal for the City of Brimbank,[10] which presents detailed Census of Population and Housing data in an interactive map; and
- the *Brimbank Atlas of Health and Education*, which includes an historical timeline of events in the Brimbank area (pages 4–6) and a demographic profile of the City of Brimbank (pages 50–52).

The suburbs [11] within Brimbank are shown in Map 2.1 over the page. The most populous suburbs are St Albans (population 36,091 at the 2011 Census), Sunshine (8,838), and Keilor (5,759).

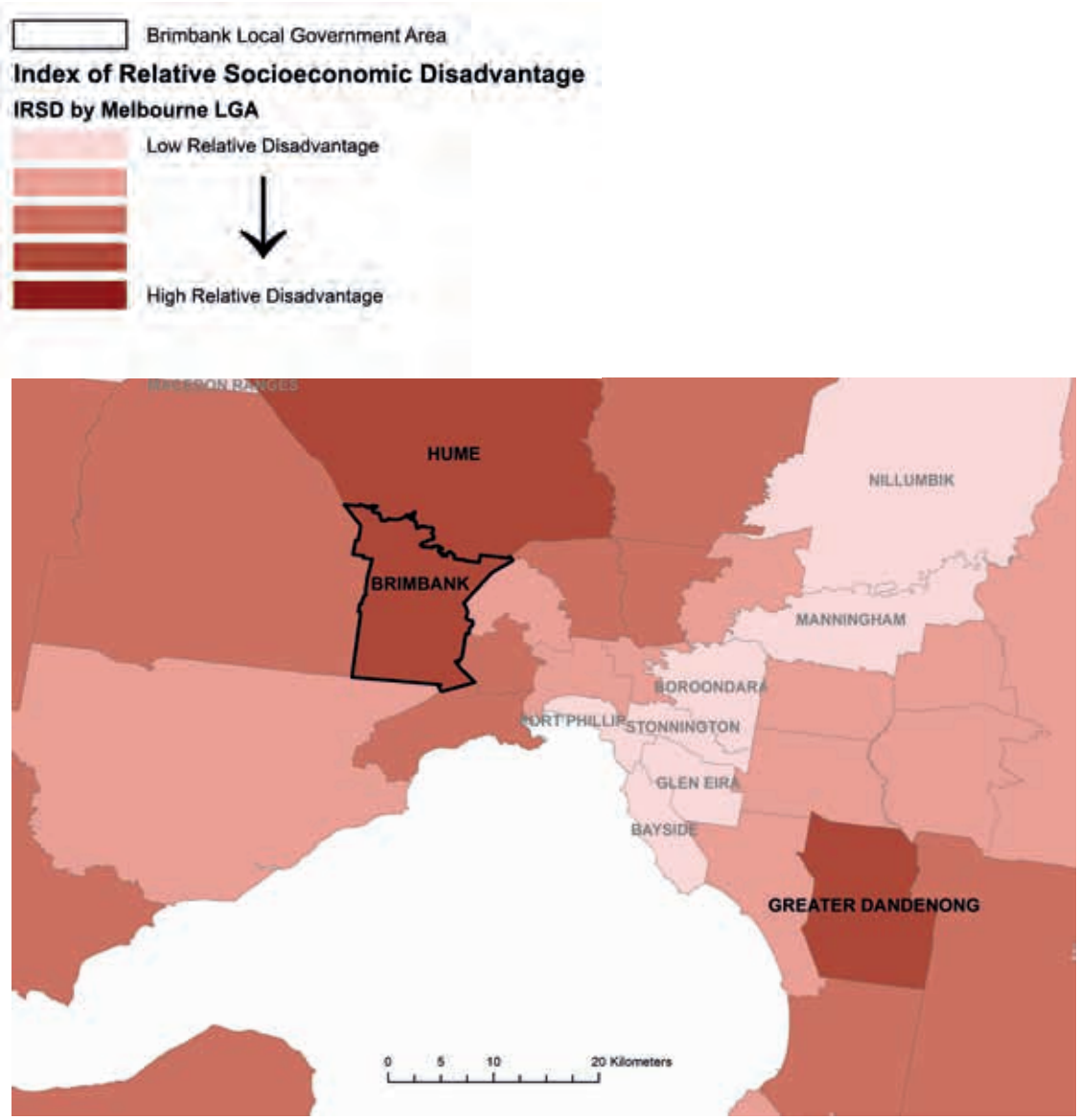
9 "About Brimbank" page on the Brimbank City Council website: www.brimbank.vic.gov.au/COUNCIL/About_Brimbank
10 .id Social atlas for Brimbank: http://atlas.id.com.au/brimbank#
11 Suburbs are also known as localities. See Chapter 3.

Why Brimbank?

The City of Brimbank reflects the myriad of policy issues and barriers associated with a rapidly growing region undergoing substantial economic and social change. Brimbank is a region on the urban edge with a long history of manufacturing industry development and subsequent de-industrialisation. Despite a substantial population of postwar immigrants and a fast-growing population of more recent migrants and refugees, there has been relatively low investment in infrastructure to meet these challenges to ensure a prospering community.

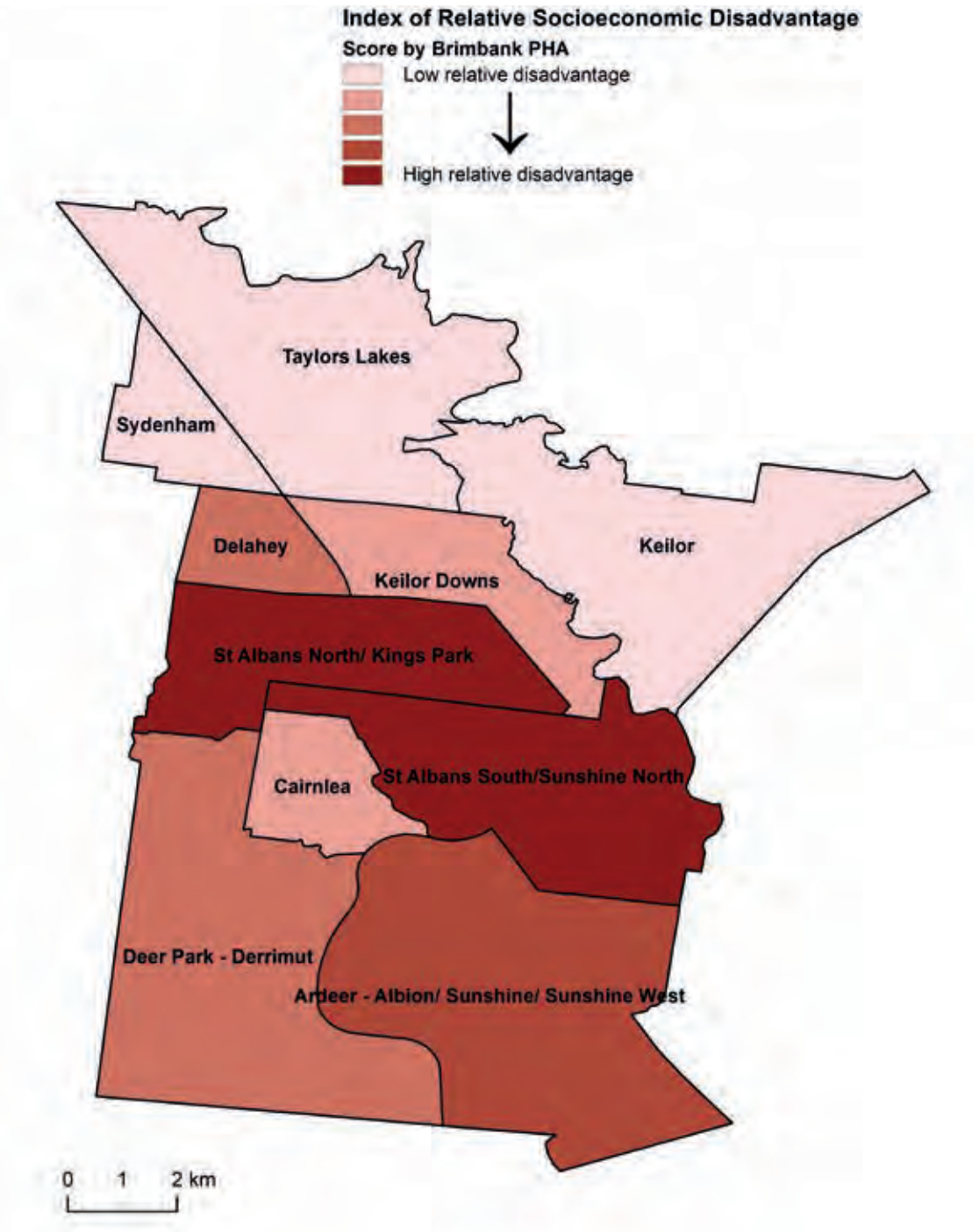
Map 2.1 Suburbs (Localities) within Brimbank

The following maps and graphs represent the range of needs and structure of the population to visualise the concept of 'many different Brimbanks'. This is done through the lens of varying levels of disadvantage; age groupings; ethnic and religious make-up; residential and industrial mix; and access to services via public transport and roads for private transport.



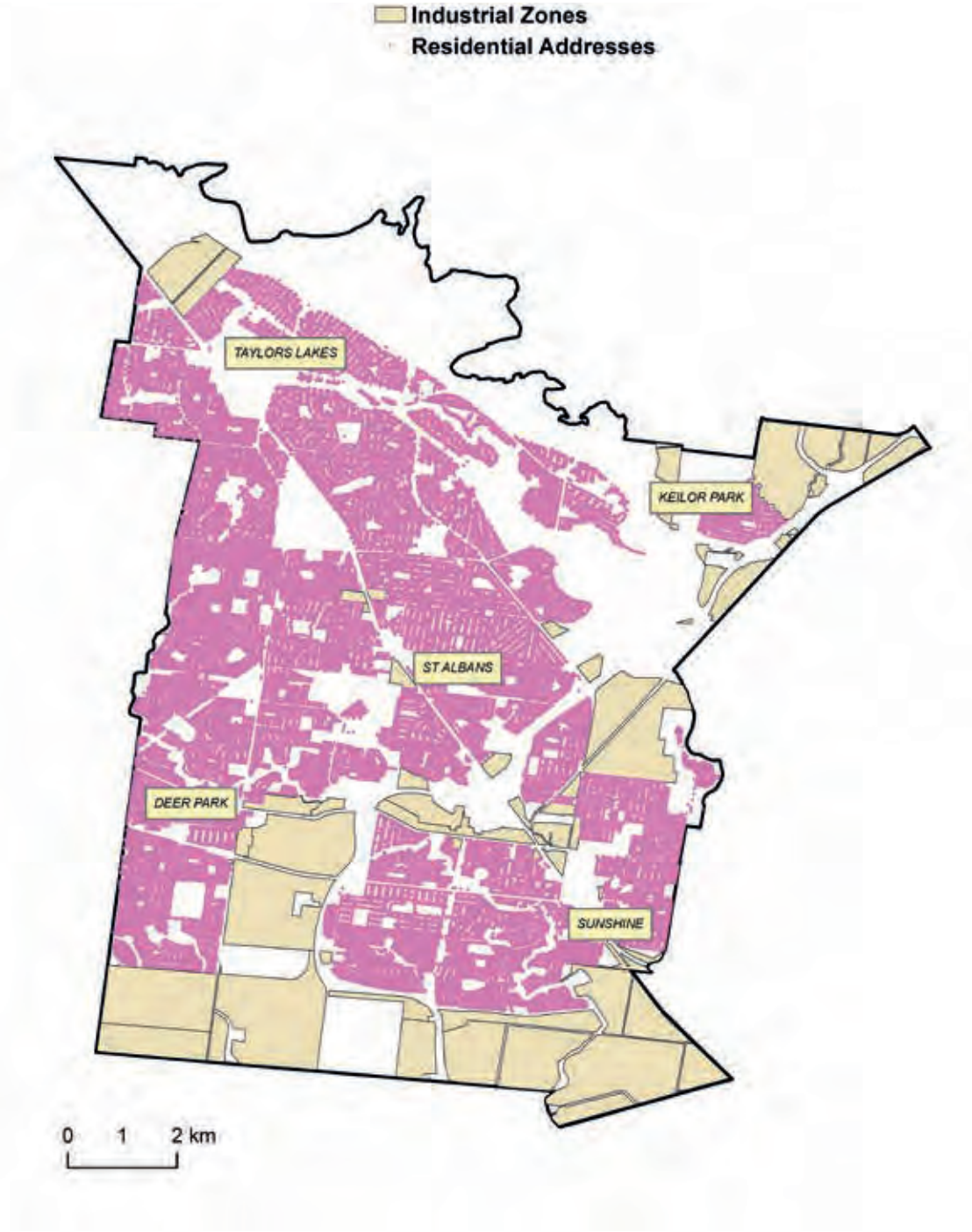
Map 2.2 Index of Relative Socio-economic Disadvantage by LGA, Melbourne

Darker LGAs are relatively more disadvantaged. Brimbank, Hume and Greater Dandenong rank as the most relatively disadvantaged LGAs in Melbourne.



Map 2.3 Index of Relative Socio-economic Disadvantage by PHA, Brimbank

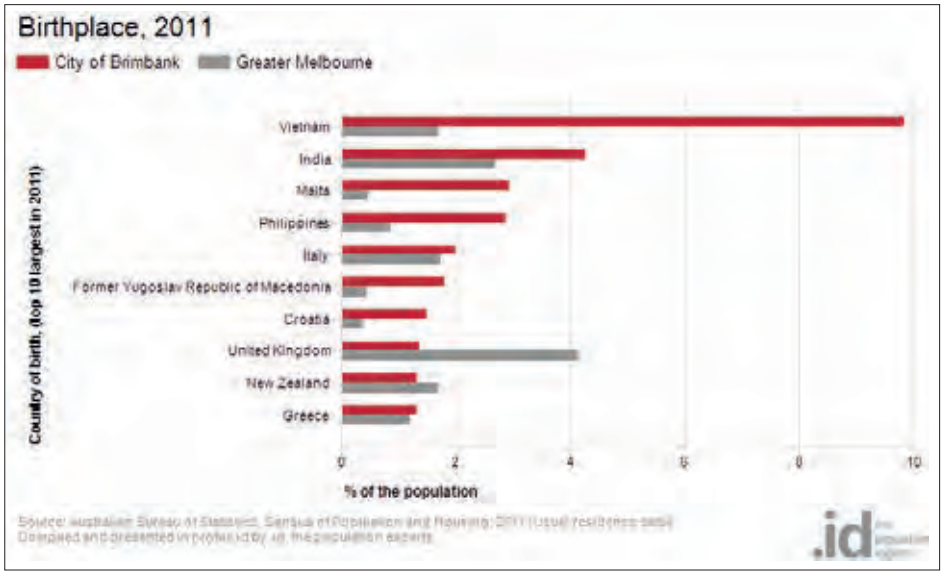
St Albans and Kings Park are the most disadvantaged PHAs in Brimbank.



Map 2.4 Residential and Industrial Zones in Brimbank, with guide suburb labels

Note this map represents residential and industrial zones only; the white areas represent the many other planning zones – public use, parkland, mixed use, and commercial use.

Figure 2.1 Cultural diversity of the migrant population in the City of Brimbank by Birthplace



- 84,285 people who were living in the City of Brimbank in 2011 were born overseas, and 20% arrived in Australia within the five years prior to 2011.
- 43% of people, came from countries where English was not their first language.
- 56% of people spoke a language other than English at home.

Figure 2.2 Change in religion, City of Brimbank, 2006 to 2011

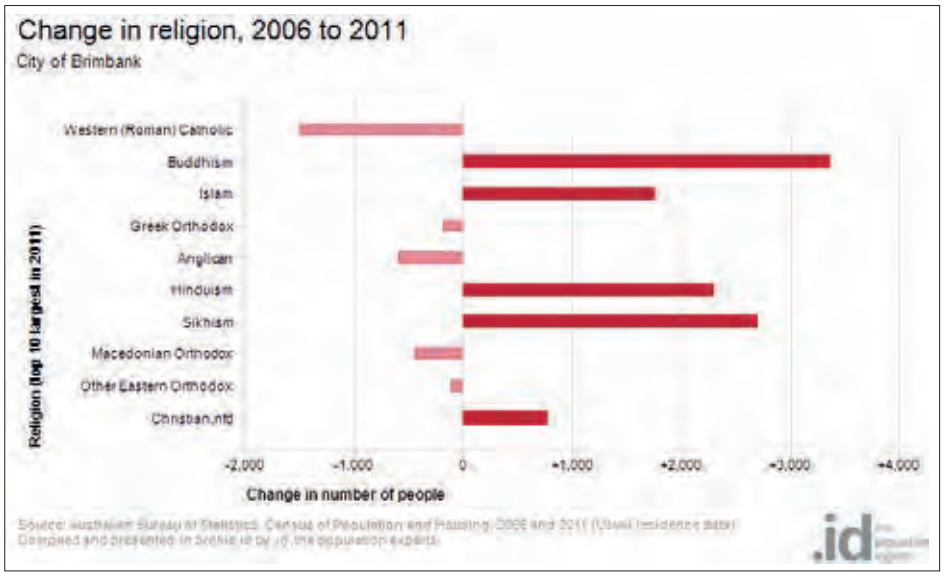


Figure 2.3 Age structure by 5-year age groups in Brimbank, 2011

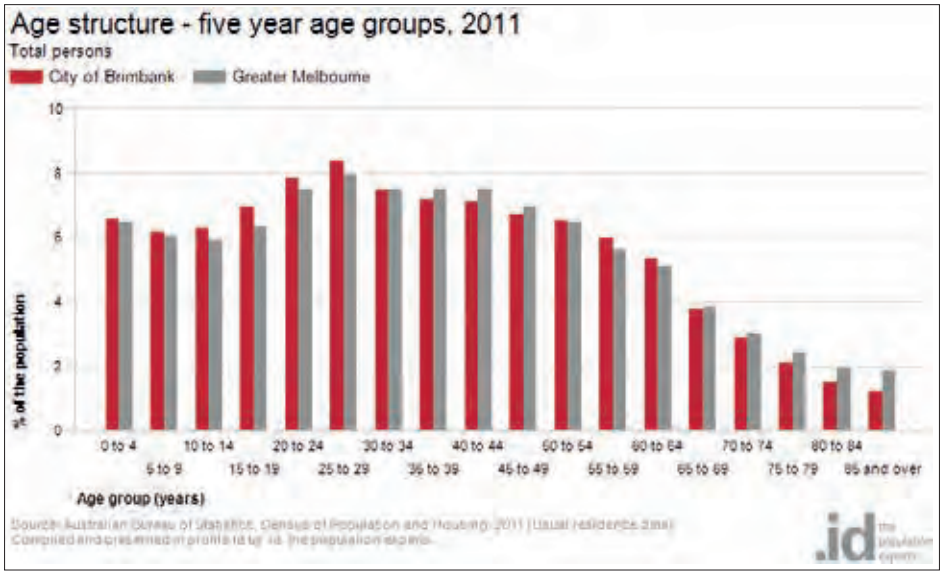
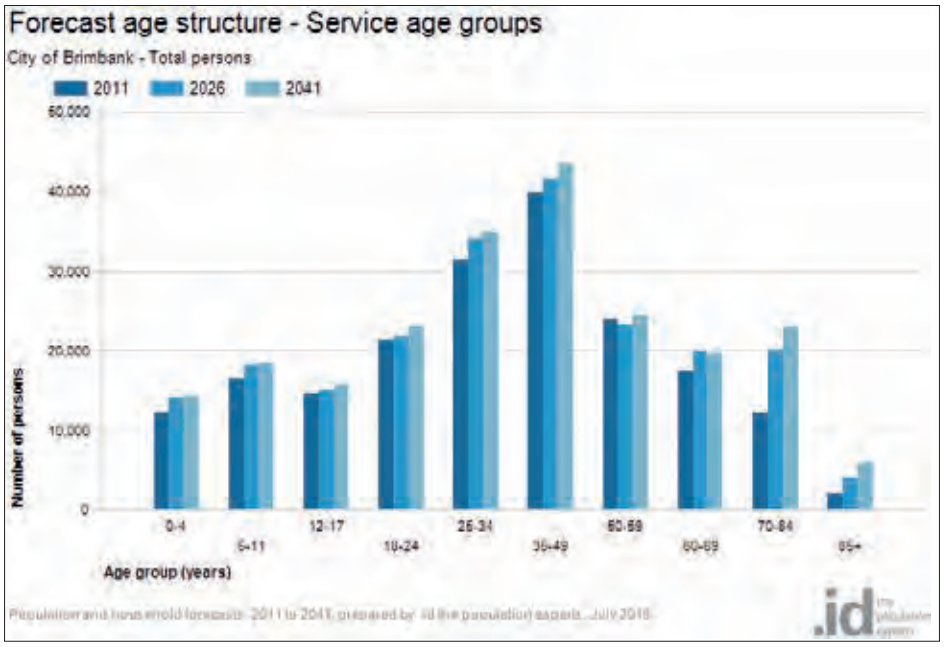


Figure 2.4 Forecast age structure by service groups



Map 2.5 City of Brimbank Public Transport and Major Roads

Major and main roads and train lines within and bisecting the city of Brimbank .
(see: http://planning-schemes.delwp.vic.gov.au/schemes/brimbank/maps)

Section 3: Method

This section provides a brief description of the methods of processing and analysing the data captured in this report, and of some relevant concepts in spatial data to aid interpretation of the results in Section 4. The descriptions are intended for newcomers to spatial data. The relevant concepts in spatial analysis, datasets and items used, and more detailed information on how to read correlation outputs, are contained in **Appendix A**.

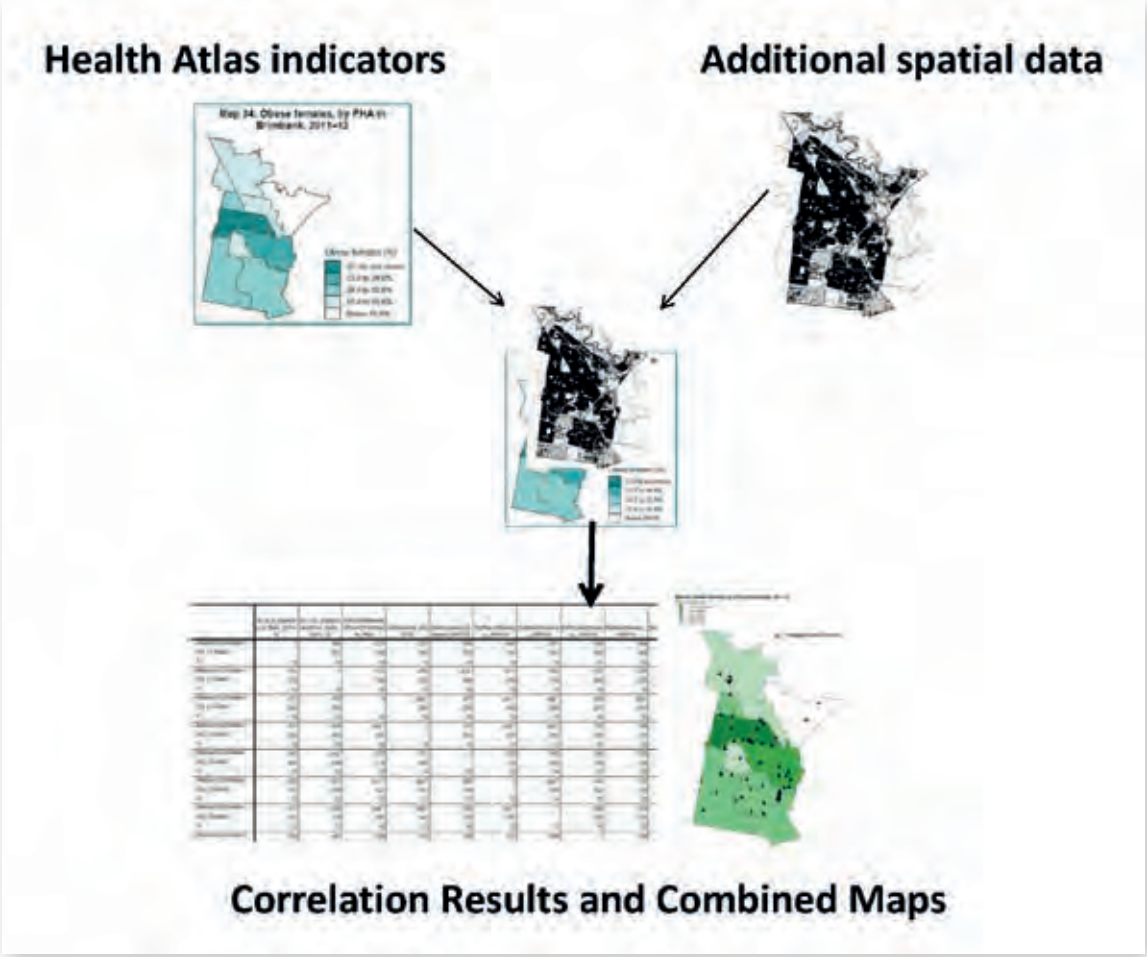


Figure 3.1 Simplified methodology

3.1 Method in brief

The diagram above (Figure 3.1) shows the basic concept of the methodology.

Two main groups of data were collected, combined based on location, then presented as correlation results and combined maps.

The two main groups of data were:

1. **Selected indicators of health and wellbeing**

   The set of health and wellbeing indicators used are drawn from the *Brimbank Atlas of Health and Education* (2014), and are downloadable from the PHIDU website.

   (NB. The summaries of correlations for each risk factor are presented in the past tense, reflecting the timing of the data collections used, such as the Australian Census 2011 and the plans for revision as new data becomes available)

2. **Social and physical infrastructure assets and features within Brimbank**

   AHPC identified local community assets (and deficits) that could be relevant to health and wellbeing outcomes. The accessible spatial datasets included food outlets, kindergartens, sports fields, public transport, accident black spots and commercial fitness providers.

The aim of this process was to provide visual and statistical information on how place (features and social and physical infrastructure) and circumstances in which people live have a bearing on their health and wellbeing outcomes.

Correlation results and maps can visually highlight patterns, or in some cases the absence of patterns, especially when maps are combined to show the overlays and associations of features.

Blending map features to produce correlation results allows us to see *coverage* and *proximity* as separate measures of access to features.

Coverage measures how many of a particular feature type are found in an area. For example, bus stops per person, or bulk billing doctors per person.

Proximity measures how close (on average) residents are to various features – for example, proximity of libraries to residences.

Coverage and proximity measures are listed in Appendix A.

The primary purpose of exploring coverage and proximity was to measure variation between PHAs.

Together these measures inform thinking on the health and wellbeing indicators from *The Brimbank Atlas of Health and Education*. In particular, they assist in answering the following questions:

- are there concentrations of assets or deficits in particular areas? and
- are there possible connections between datasets?

In this way, health and wellbeing data can be considered and explored alongside indicators of the prevalence of features. For example, rates of smoking and obesity can be portrayed alongside the number of take-away food outlets and open space trees per person in each Brimbank PHA.

A note of caution: the correlation results were generated at PHA level – the smallest geographical area at which the health and wellbeing indicators are reported. However, this level of correlation results is approximate (without being unreliable) and must be interpreted together with the maps (and combined maps) and the written discussion.

The geographical areas used for different reporting needs require explanation. In descending order of size, these are LGAs, Statistical Local Areas (SLAs), Statistical Areas Level 1 (SA1s), Localities/Suburbs, and PHAs.

PHAs are a combination of Suburbs and SLAs. PHAs are specifically used for Australian health data, as they are small enough to convey internal variation within LGAs.

In this report, correlations are always referred to as 'at Brimbank PHA level'. It is possible that different results could be returned for maps at a wider scale: at SLA level in Victoria or Melbourne, for example, or LGA level in Australia.

The levels are represented in **Figure 3.2** below.

Figure 3.2 Geographical and statistical areas within Brimbank

3.2 How to read correlation outputs

A correlation coefficient is a numerical expression of the strength of association between two continuous variables. Significant correlations can be positive or negative, but these terms do not mean 'beneficial' or 'detrimental', nor do they imply causation. Generally, correlation coefficients of magnitude greater than 0.71 have been flagged as significant in this report.

- Correlations help us appreciate the extent of association between a health outcome and a specific asset.
- A significant correlation coefficient with a minus sign (ie. closer to -1) indicates a negative – or *inverse* –correlation. That is, two variables fluctuate at a similar rate, but in opposite directions. For example, the higher the mileage on a second-hand car, the lower the sale price (all else equal); this is an inverse correlation.

A correlation coefficient closer to +1 indicates a positive association between two variables. That is, they vary at a similar rate and in the same direction; for example, the time spent walking and distance travelled will be positively correlated.

In this report, a double asterisk after the correlation coefficient (**) indicates a correlation of magnitude 0.75 or more (strong).

The two **example tables** overleaf convey correlation information about a desirable health outcome: children developmentally on track under the physical health and wellbeing domain (derived from the Australian Early Childhood Census – see Section 4.6).

Outputs from GIS can show *where* a factor exists and to what extent, but cannot provide an answer to *why*. Regardless of the positive and negative results, the reader should not conclude, for example, that play centres directly help children be on track developmentally, or that state primary schools do the opposite.

The results indicate *correlation*, not *causality*.

A correlation matrix is provided as an abridged version of the almost 150 variables explored in this report (see at Appendix B). Its purpose is to enable the reader to quickly gauge the 'heat map' of what are the most important associations of physical and social infrastructure with poor health and education outcomes and what might be the 'clusters of interest'.

For the Positive Correlation Table:

The PHAs in Brimbank with higher estimated rates of children developmentally on track also had:

- greater proximity to indoor play centres; and
- more parkland; greater proximity to takeaway food outlets.

Children developmentally ON TRACK under the physical health and wellbeing domain
Positive Correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high rates of children developmentally on track under the physical health and wellbeing domain
Physical and social infrastructure Indoor play centres – proximity to residences (.847**) Take away food outlets [chain] – per person (.668*) Percentage of Parkland (.637*) **Health and wellbeing indicators** [no significant results] **Contextual indicators** [no significant results] **Education and child development** [no significant results] **Demographics** [no significant results]

For the Negative Correlation Table:

The PHAs in Brimbank with higher estimated rates of children developmentally on track also had:

- greater distances from state primary schools and from packaged liquor licenses; and
- higher proportions of dwellings in rental stress and dwellings in mortgage stress.

Children developmentally on track under the physical health and wellbeing domain
Inverse Correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs, with high rates of children developmentally on track under the physical health and wellbeing domain
Physical and social infrastructure State primary schools – proximity to residences (-.727*) Packaged liquor licenses – proximity to residences (-.660*) **Health and wellbeing indicators** [no significant results] **Contextual indicators** Dwellings in rental stress (-.759*) Dwellings in mortgage stress (-.656*) **Education and child development** Children developmentally vulnerable on one or more domains (-.811**) **Demographics** [no significant results]

Note

It is important to consider both positive and negative correlations to get the full picture and **understand that correlations mean statements are also true in reverse**. So, we could say that:

The PHAs in Brimbank with higher estimated rates of children developmentally on track also had:

- *greater proximity to indoor play centres;*
- *more parkland;*
- *lower proportions of dwellings in rental stress and dwellings in mortgage stress;*
- *lower proportions of children developmentally vulnerable on one or more domains; and*
- *greater distances from state primary schools and from packaged liquor licenses.*

The PHAs in Brimbank with lower estimated rates of children developmentally on track also had:

- *less proximity to indoor play centres;*
- *fewer chain take away food outlets per person;*
- *less parkland;*
- *higher proportions of dwellings in rental stress and dwellings in mortgage stress; and*
- *greater distances from state primary schools and from packaged liquor licenses.*

Section 4: Analysing selected Brimbank indicators using additional spatial datasets

This section presents analysis of six selected health and wellbeing indicators from *The Brimbank Atlas of Health and Education*, using additional spatial datasets (as described in Section 3). The results are presented in the form of correlation tables and overlay maps, followed by a discussion, for each selected indicator. Where relevant, maps of greater Melbourne are included.

The Brimbank Atlas of Health and Education (2014) describes the incidence of these health and wellbeing indicators in the Brimbank population.

The indicators considered are:

4.1 Self-assessed health status reported as 'poor' or 'fair'

4.2 Obesity

4.3 Diabetes

4.4 Psychological distress reported as 'high' or 'very high'

4.5 Hospitalisations for ambulatory care-sensitive conditions

4.6 Children developmentally vulnerable on one or more domains

These health and wellbeing indicators were selected because each is:

- a risk factor for preventable chronic disease/ conditions; or
- a risk factor that, in combination with others, has significant impact on levels of health and wellbeing, disease and disability in the community.

Several indicators are above Melbourne, Victoria, and Australian averages within Brimbank.

Subsections 4.1 to 4.4 and 4.6 present health and wellbeing indicators with many similarities.

Read in succession, these subsections demonstrate that disadvantage and poor health overlap in multifaceted ways. Self-assessed fair or poor health, obesity, diabetes, psychological distress, and smoking show similar (but not identical) patterns, with concentrations in areas of higher relative socio-economic disadvantage.

Subsection 4.5 – Hospitalisations for ACSCs – shows an unusual pattern, with the highest rates of hospital presentation occurring in areas of lower relative socio-economic disadvantage.

Each subsection is structured as follows.

1. Summary box
2. General information on the selected risk factor, reflecting findings from *The Brimbank Atlas of Health and Education 2014*
3. Correlations at Brimbank PHA level:
   - a positive correlation table
   - an inverse correlation table
   - a summary
4. Maps
5. Discussion

4.1 Self-assessed health status reported as 'fair' or 'poor'

4.1.1 Summary box

Self-assessed health (SAH) can reflect many aspects of how people feel physically and emotionally.

While 14.6% of Australians in 2011–12 assessed their own health as 'poor' or 'fair', in Brimbank this figure was 20.3%. The highest rates of self-assessed poor or fair health were in the most socio-economically disadvantaged areas of Brimbank. This pattern of correlation of poor health with disadvantage is repeated throughout this report.

The PHAs in Brimbank with the highest rates of self-assessed poor or fair health also have:

- higher numbers of packaged liquor licenses
- higher numbers of bulk billing GPs;
- fewer trees and less parkland than the rest of Brimbank;
- fewer fitness businesses per person;

Contextually these are strongly associated with joblessness and / or lower incomes and higher population density in these areas; and many incorporated community groups, a large percentage of which have a CALD composition, but fewer people engaged in voluntary work.

4.1.2 Self-assessed health status

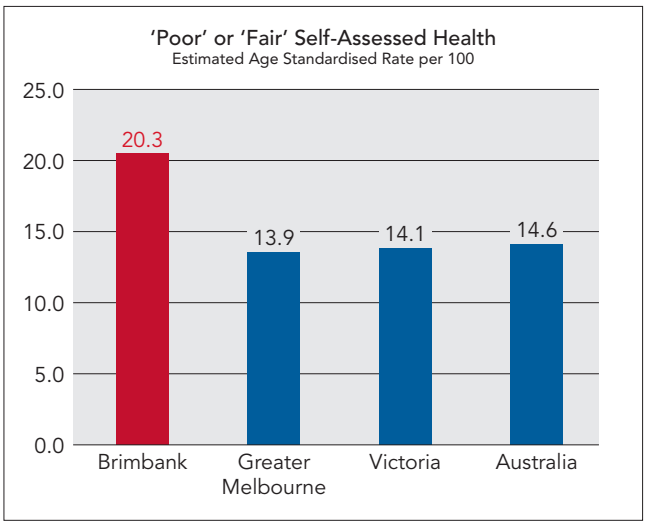
In 2011–12, over half (55%) of Australians aged 15 years and over rated their health as 'very good' or 'excellent', and very few rated their health as 'poor'. However, the picture in Brimbank is less positive.

The Brimbank Atlas of Health and Education presents estimates[12] of the rates of Brimbank residents aged 15 years and over who reported their health as 'poor' or 'fair'. It shows that rates of self-reported fair or poor health were high in Brimbank compared to Australia as a whole (20.3 people per 100 in Brimbank, 14.6 people per 100 in Australia).

Moreover, *The Brimbank Atlas* revealed considerable variation in the level of **spatial concentration** of self-assessed poor or fair health in Brimbank. Rates were highest in two particular Brimbank PHAs: St Albans – North / Kings Park (26% above the Brimbank average), and St Albans – South / Sunshine North (18% above the Brimbank average).

While the rates of self-assessed poor or fair health were high throughout Brimbank, the rates in these two PHAs were well above the national and Melbourne averages (see table opposite).

Maps 4.1.1–4.1.5 show SAH data for Brimbank and Melbourne, for Brimbank's PHAs, and overlays of key indicator data.



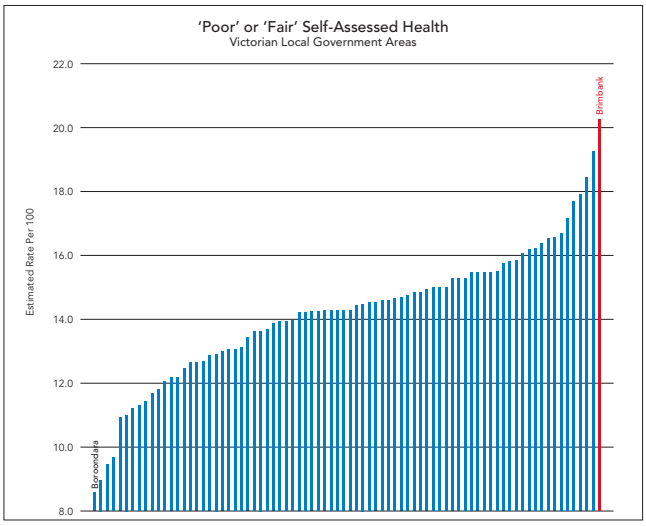


Fig 4.1.1 Comparisons of Brimbank rates of self-assessed health status with greater Melbourne, Victoria, and Australia, 2011

12 Rates were estimated by the Australian Bureau of Statistics, from the *2010 General Social Survey* and from the *Australian Health Survey 2011–13*. Refer to the data descriptions in Appendix C of the *Brimbank Atlas of Health and Education* (2014), p. 157.

4.1.3 Correlations at Brimbank Population Health Area level

Estimated Rates of Self-Assessed Poor or Fair Health
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high rates of self-assessed poor or fair health
Physical and social infrastructure
Cultural supermarkets – per person (.868**)
Packaged liquor licenses – proximity to residences (.792**)
State primary schools – proximity to residences (.776**)
Bulk billing GPs – proximity to residences (.738*)
Late-opening GPs – proximity to residences (.534)
Health and wellbeing indicators
Estimated rates of diabetes (.960**)
Estimated rates of male smokers (.946**)
Estimated rates of female obesity (.900**)
People aged under 65 living with a disability (.932**)
Estimated rates of harmful alcohol use (.883**)
Estimated rates of psychological distress (.841**)
Estimated rates of male obesity (.653*)
Contextual indicators
Percentage of jobless families (.984**)
Socio-economic disadvantage (.982**)
Percentage of single-parent families (.957**)
Dwellings in mortgage stress (.914**)
Percentage born in NES country (.895**)
Dwellings with no motor vehicle (.826**)
Dwellings in rental stress (.726*)
Education and child development
Rates of early school leavers (.916**)
Children developmentally vulnerable on one or more domains (.774**)

Estimated Rates of Self-Assessed Poor or Fair Health
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high rates of self-assessed poor or fair health
Physical and social infrastructure Trees [open space] – per person (-.822**) Percentage of parkland (-.741*) Trees [street] – per person (-.720*) Fitness businesses [all] – per person (-.711*) Conservation zones – total square metres (sqm) per person (-.697*) Gyms – per person (-.638*) Late-opening GPs per person(-.054) **Health and wellbeing indicators** [no significant results] **Contextual indicators** People engaged in voluntary work (-.774**) **Education and child development** Children developmentally on track – language and cognitive skills (-.687*) Percentage learning or earning aged 15 to 19 (-.683*) **Demographics** [no significant results]

4.1.4 Summary of correlations

In the PHAs in Brimbank with higher estimated rates of **self-assessed poor or fair health**, the prevalences of diabetes, male smokers, female obesity, harmful alcohol use and psychological distress were high and associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

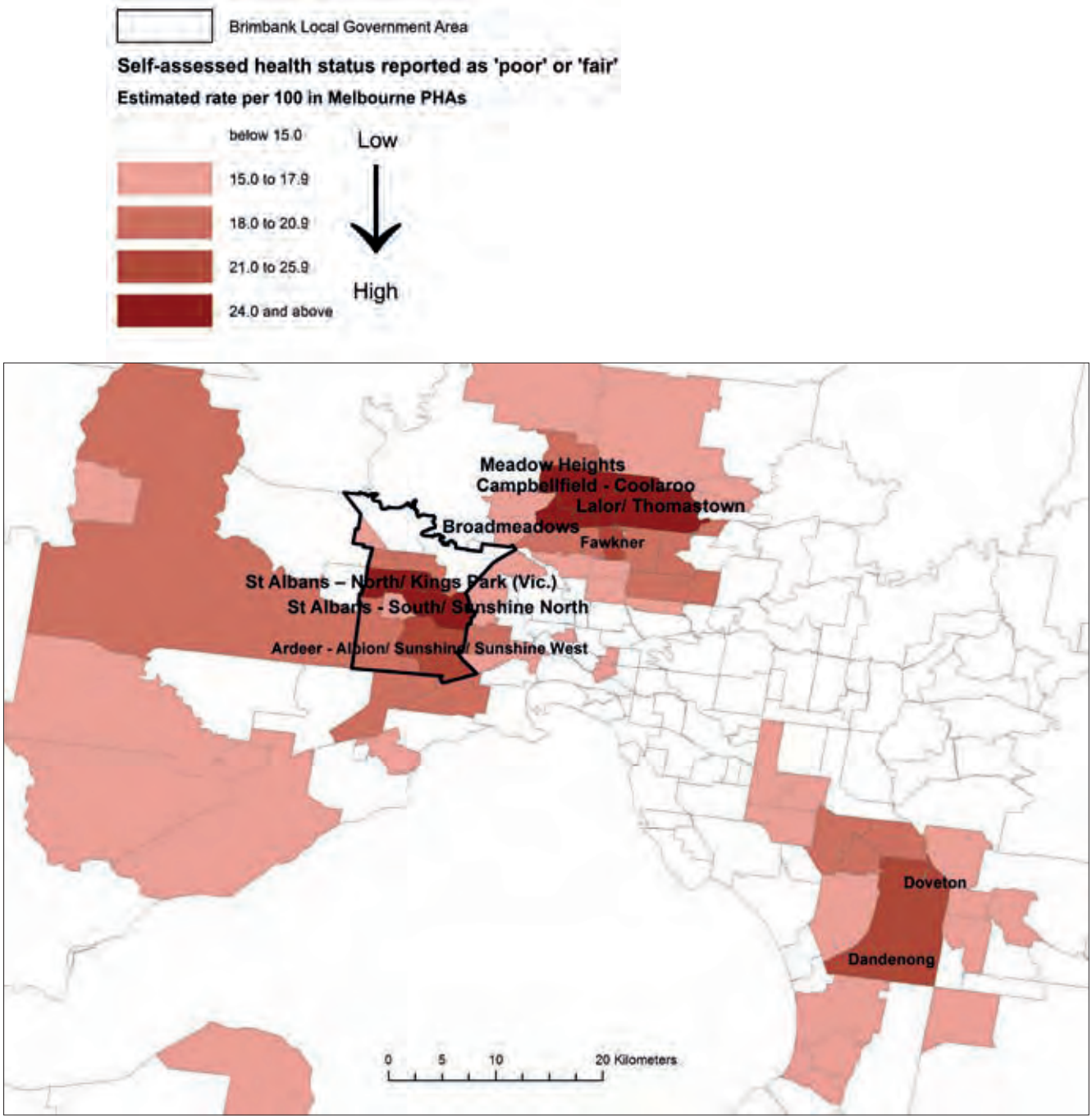
Infrastructure

- *Significantly* greater proximity to packaged liquor licenses, state primary schools, and bulk-billing GPs.
- Fewer trees, fewer conservation zones, fewer gyms, and fewer fitness businesses per person.
- Fewer hills.
- Less parkland.

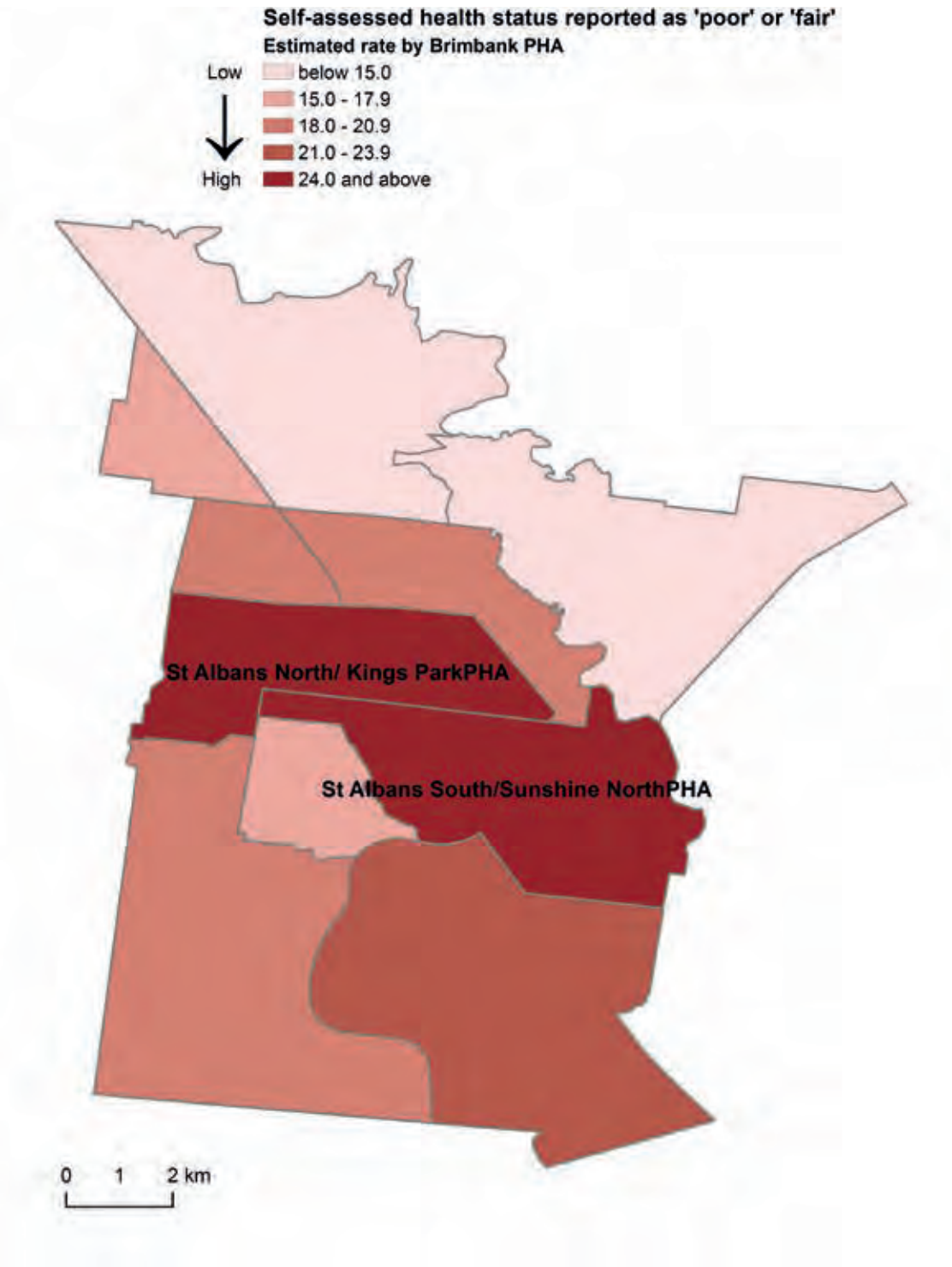
Contextual indicators

- *Dwellings with no motor vehicle*.
- More people aged under 65 years living with a disability.
- *Greater socio-economic disadvantage*.
- *Higher proportions of jobless families, single-parent families, dwellings in mortgage and rental stress, people born in non-English-speaking (NES) countries*.
- Higher proportions of early school leavers and developmentally vulnerable children.
- Lower proportions of people engaged in voluntary work, and lower proportions of people aged 15 to 19 who were learning or earning.

4.1.5 Maps

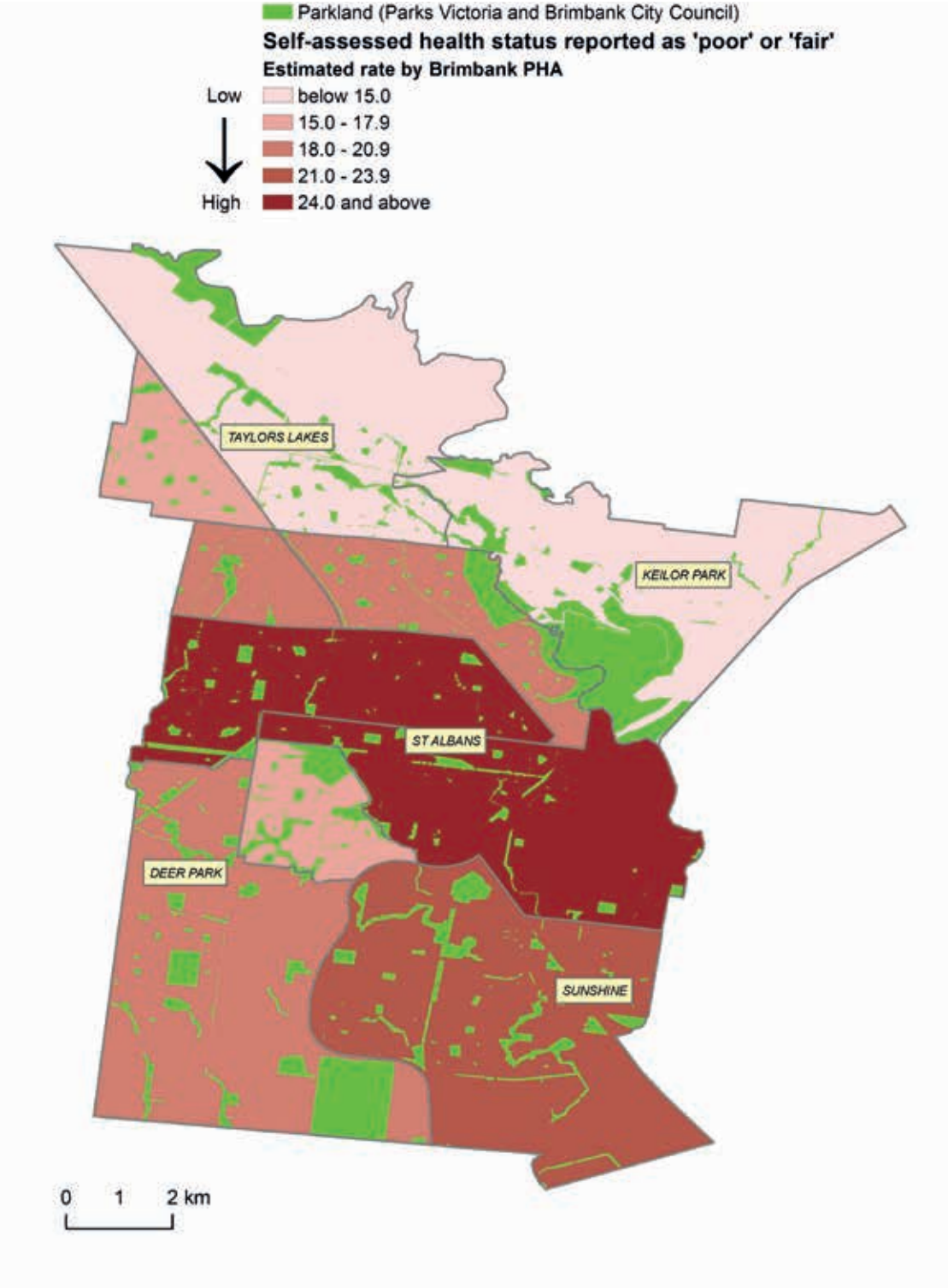


Map 4.1.1 Rates of self-assessed poor or fair health in Melbourne PHAs



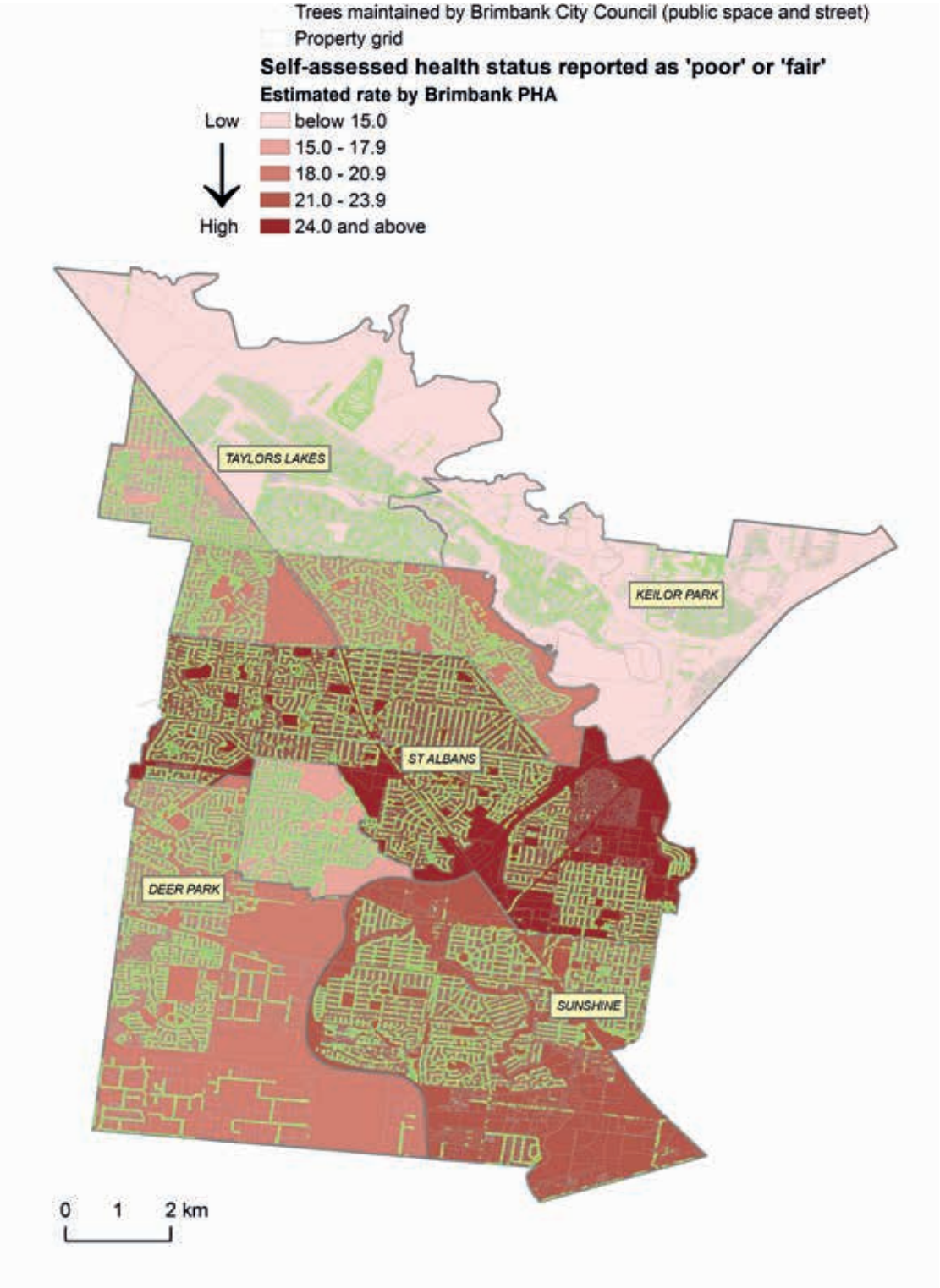
Map 4.1.2 Rates of self-assessed poor or fair health in Brimbank PHAs

Map style from page 106 in Brimbank Atlas of Health and Education



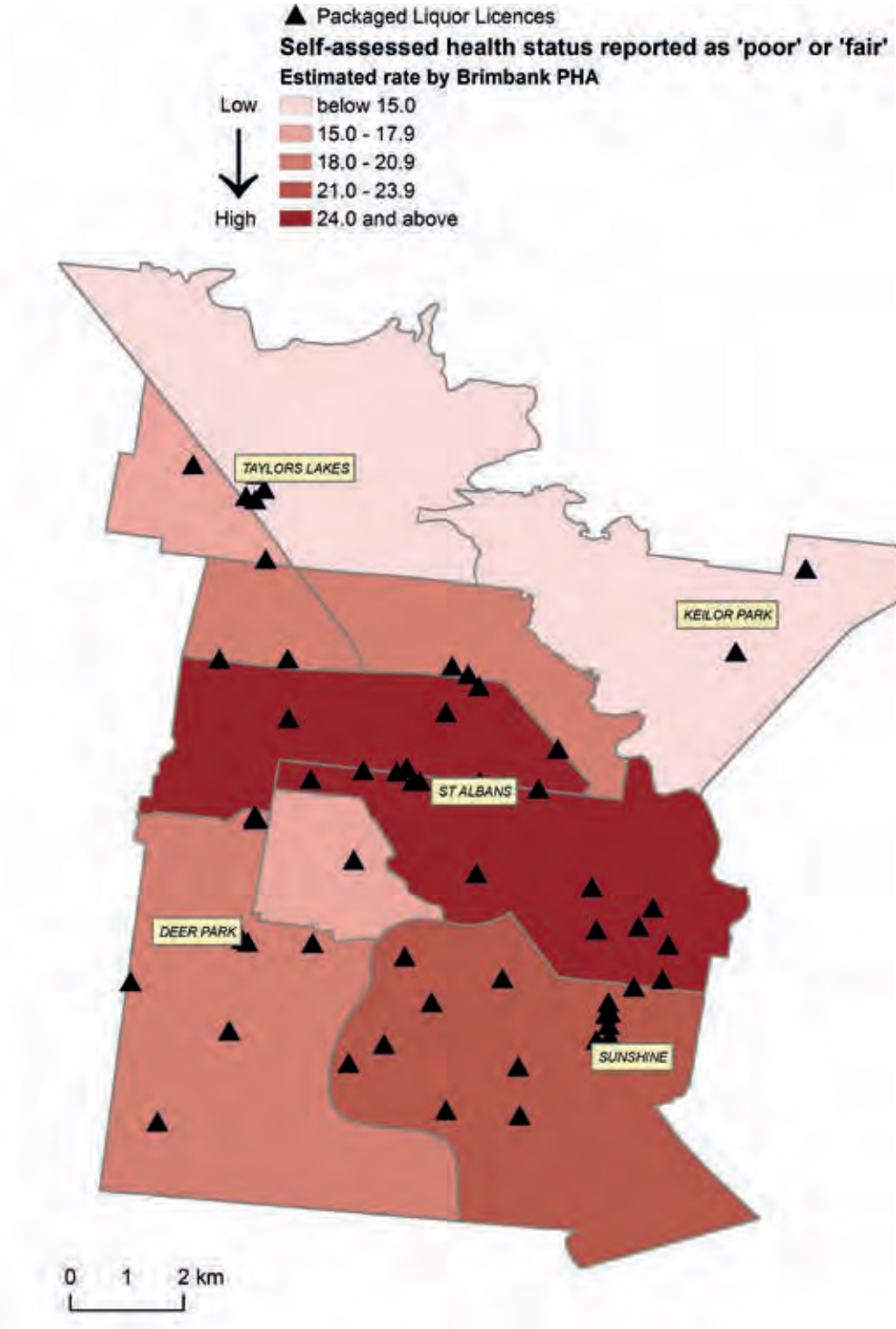
Map 4.1.3 Rates of self-assessed poor or fair health in Brimbank PHAs

Overlay of parkland (Parks Victoria and Brimbank City Council)



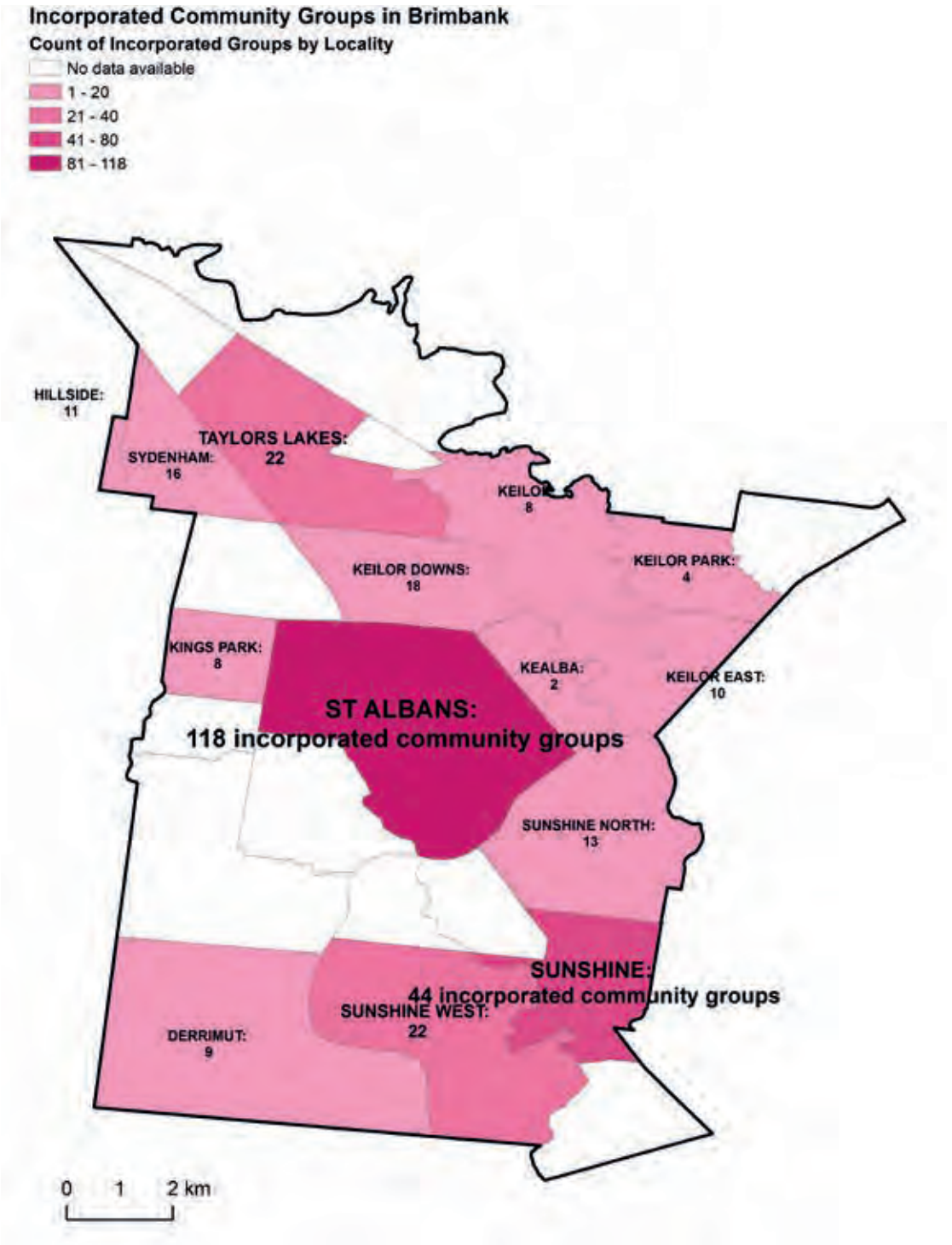
Map 4.1.4 Rates of self-assessed poor or fair health in Brimbank PHAs

Overlay of trees (public space and street)



Map 4.1.5 Rates of self-assessed poor or fair health in Brimbank PHAs

Overlay from packaged liquor licences



Map 4.1.6 Incorporated community groups by Brimbank suburb (locality)

The highest numbers of community groups are recorded largely in those PHAs which are the most disadvantaged, that is St Albans / Sunshine North (IRSD 849) and Sunshine (IRSD 894), although by comparison Ardeer (IRSD 882) records no community groups.

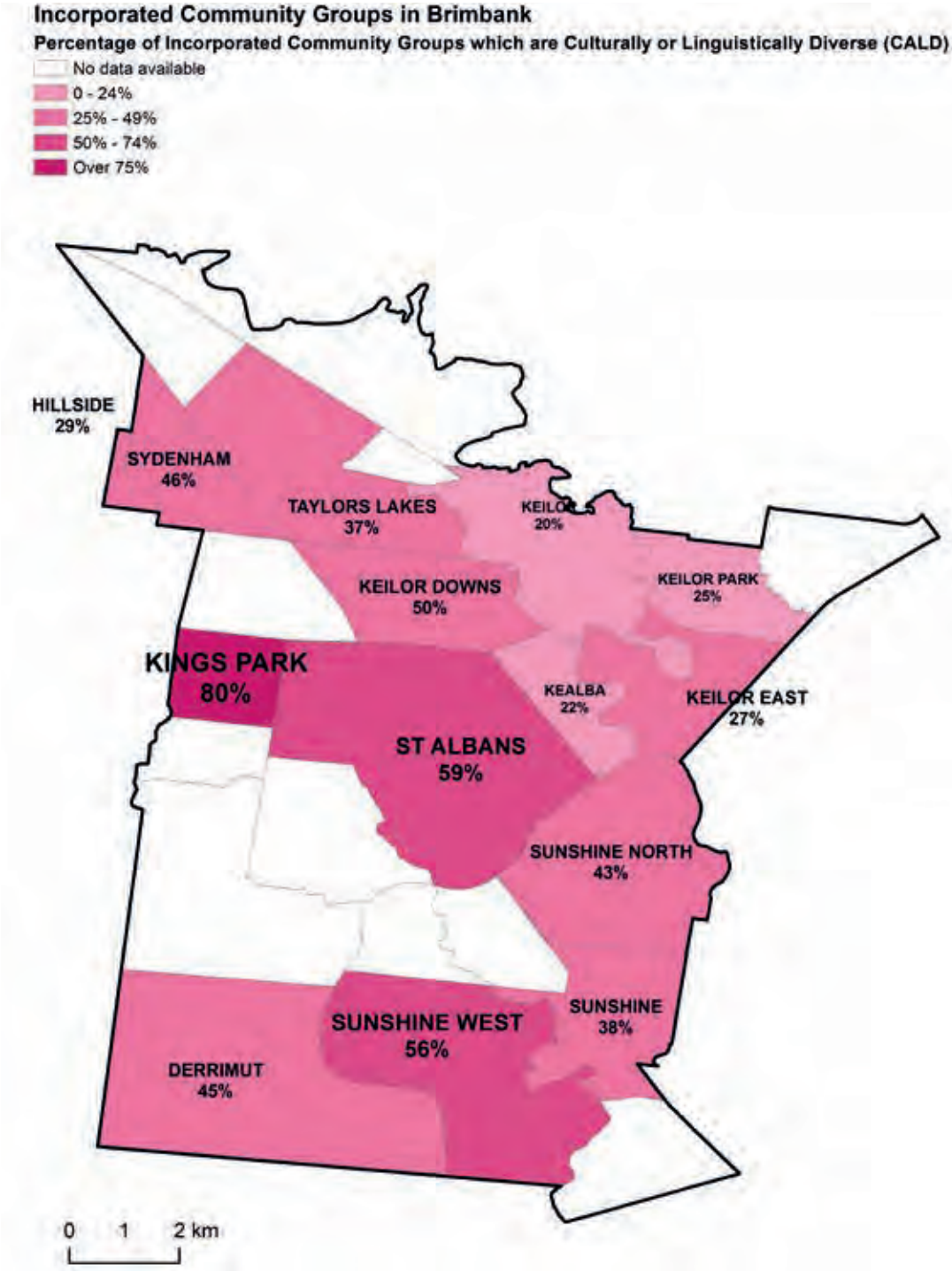
Suburb	Incorporated community groups – total
Derrimut	20
Hillside	38
Kealba	9
Keilor	41
Keilor Downs	36
Keilor East	37
Keilor Lodge	3
Keilor Park	16
Kings Park	10
St Albans	200
Sunshine	115
Sunshine North	30
Sunshine West	39
Sydenham	35
Taylors Lakes	60

Table 4.1.1 Incorporated community groups in Brimbank – count by suburb

Community group category	Total Brimbank incorporated community groups assigned to this category	Percentage of Total (note that groups can be assigned to 1 or 2 categories and hence total more than 100%)
CALD	305	44%
Charity and support groups	74	11%
Children and families	55	8%
Civic	96	14%
Elderly	57	8%
"Friends of"	7	1%
Hobbies and interests	94	14%
Religion	97	14%
Sport	123	18%

Table 4.1.2 Incorporated community groups in Brimbank – percentage CALD

Excluding the CALD-specific community groups, the purpose of tabling these groups and their CALD composition (as a % of the total) is to provide insight into the social capital and positive social assets available as public goods.



Map 4.1.7 Incorporated community groups in Brimbank – percentage CALD

Community groups which are identified as CALD appear to be located in those PHAs with the greatest levels of disadvantage, such as St Albans North / Kings Park (IRSD 849), and the highest levels of poor or fair self-assessed health. This may reflect bonding or social capital where social networks between like-minded groups can be valuable to support their collective needs.

4.1.6 Discussion

Self-assessed health is often used to assess population health. However, as a multi-faceted measure, it requires careful interpretation.

> *… a shortcoming of SAH is that it provides little guidance to researchers as to what individuals are thinking of when they assess their health. (Schreibman et al. 2008, p. 21)*

Higher rates of reported poor and fair health could indicate higher rates of illness, or inadequately managed illnesses, or low social support and community engagement, general low quality of life, or combinations thereof.

The health and wellbeing correlations for self-assessed fair or poor health in Brimbank are numerous and have been established in *The Brimbank Atlas*. The two strongest correlations shown at PHA level are the IRSD and jobless families. The connection between self-assessed health and socio-economic status (Kunst et al. 2005) is well established.

However, the list of significant physical and social infrastructure correlations found in Brimbank was short in comparison to the long list of contextual and health correlations.

The PHAs in Brimbank with highest rates of self-assessed poor or fair health (St Albans North and St Albans South) have:

- greater proximity to packaged liquor licenses and bulk-billing GPs; but
- fewer trees, less parkland, and fewer gyms.

These facts can be interpreted as:

a) a simple function of variations of the built environment in Brimbank; and/or
b) reflecting population and public health research, which shows correlations between socio-economic status, the built environment, and health (Knox et al. 2005, Dorling 2013, Giles-Corti et al. 2013).

Some of these research findings are discussed below.

Trees

Brimbank PHAs with higher rates of self-assessed poor or fair health also had fewer open space trees per person, fewer street trees per person, fewer square metres of conservation zone per person, and a lower percentage of parkland. These variables are interrelated and express the same basic pattern that occurs in other Brimbank PHAs: less socio-economically disadvantaged areas, with fewer health risk factors, have more trees and parkland per person. This can be seen in the overlay maps preceding this discussion. However, it is important to remember that the density of trees per person is partly a function of housing density.

A recent study compared Melbourne tree canopy in five different LGAs over the 10 years from 2001–2011 (Krafft & Fryd, 2016). This did not include Brimbank, but did include the neighbouring LGA of Maribyrnong. This study reiterated that higher-income areas tend to have denser tree canopies – a consistent finding across many countries:

> *Broadly speaking, former income appears to have the strongest correlation to future tree cover in inner Melbourne. These findings are in full agreement with the majority of academic literature on the topic. It has been consistently demonstrated across cities and continents with varying climates. (Krafft & Fryd, 2016, p. 48)*

In addition, the Greater Melbourne tree canopy study investigated change over time, finding that the canopy has grown since the early 2000s but is becoming more unequal over time. The higher-income LGAs increased tree cover more than lower-income LGAs.

In the context of the large body of research linking income to tree cover, the inverse correlation in Brimbank between trees and self-assessed poor or fair health can be viewed partly as a restatement of the connection between self-assessed health and socio-economic status. The built environment can both reflect and reinforce health and wellbeing outcomes.

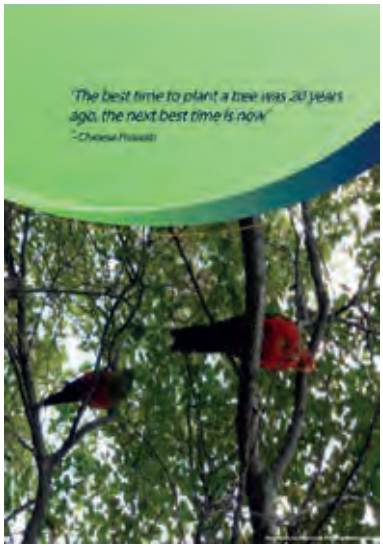
Tree cover can reflect socio-economic status and not necessarily provide direct health benefits. However, there is some evidence of a relationship between increasing tree cover and reduced crime (Grove & Kondo, 2016).

Initiatives are underway to soften the association between low income and the extent of tree cover in Melbourne. In 2016 Brimbank City Council adopted an Urban Forest Strategy, one of the few LGAs in Australia to do so. Its aim is to **increase Brimbank's tree canopy coverage from 6.2% to 30% over the next 30 years.**[13]

The *Brimbank Urban Forest Strategy 2016–2036* integrates maps linking heat islands, socio-economic vulnerability, and high ambulance callouts on hot days (Loughnan et al. 2010, Loughnan et al. 2013). In this research, St Albans and Sunshine were identified as particularly vulnerable to health emergencies in hot weather.

Brimbank City Council is also a partner in the Greening the West program, an initiative to develop green spaces across Melbourne's western suburbs. Greening the West lists "improving community health through provision of quality green spaces" as a core driver, and includes a literature review of research into green space and health on its website.[14]

Newly developed roads are relatively easy to target for tree cover, as they do not have overhead utilities. However, the Greening the West report acknowledges that much of Brimbank land is held privately and so cover on private land will vary. In this sense, disadvantaged areas face more of a challenge than others.



From the *Brimbank Urban Forest Strategy 2016–2036*, page 48.

Open Space

The connection between socio-economic status and open space areas is not as clear as for trees. A recent research project used GIS to compare the level of access to public open space against measures of socio-economic disadvantage in Melbourne (Mavoa et al. 2015). This study found that disadvantaged areas were, on average, *closer* to public open space than advantaged areas, but stressed that not all public open space is of equal quality as a driver of health and wellbeing. Disadvantaged areas in Melbourne are often close to the city fringe and protected areas which tend to be used less for recreation.

Crime and perceptions of safety may constrain use of public open space (Giles-Corti et al. 2005). Finally, public open space is not always the most health-promoting use of space: a mix of destinations that promote walking can be more effective in promoting physical activity and wellness (Giles-Corti et al. 2013, Owen et al. 2007).

Alcohol

For physical and social infrastructure, the strongest correlation for self-assessed fair or poor health at Brimbank PHA level was with packaged alcohol outlets (also known as bottle shops; see Map 4.1.5).

The ratio of packaged liquor licenses to the total population and the average distance from residences showed stronger correlations than simple counts. The proximity (that is, the average closeness of all residences in a given area to the outlets) was highest in St Albans / Sunshine North.

A Melbourne-wide study – *Access to alcohol outlets and harmful alcohol consumption: a multi-level study in Melbourne, Australia* (Kavanagh et al. 2011) – found evidence of a link between access to alcohol outlets and increased risk of harmful alcohol use. The study found that density of alcohol outlets was a bigger factor than proximity.

13 Media release for *Brimbank Urban Forest Strategy 2016 – 2036*, with link to full report: www.brimbank.vic.gov.au/News_and_Updates/Media_Releases_2016/May_2016/30_year_plan_for_greener_cooler_Brimbank
14 www.greeningthewest.org.au/resources/

Crime and perceived safety

Data on crime and perceptions of safety are only available in Victoria at LGA level. Hence, it is not possible to investigate variations in crime and perceptions of safety within Brimbank. However, crime rates and perceptions of safety are an important context for self-assessed health in Brimbank as a whole.

Perceptions of safety in Brimbank vary considerably by gender (see the discussion in section 4.2: Obesity). Only 22.7% of women in Brimbank report feeling safe when walking alone at night, compared to 63.9% of men, and to state averages of 63.1 % and 87.5% respectively. [15]

Brimbank as a whole has rates of crimes against the person similar to other LGAs, but higher rates of property crime.

Community groups

Brimbank City Council supplied a list of incorporated community groups by suburb for this project. Whilst not practicable to include these in correlation tables,[16] they are shown in maps (4.1.6 and 4.1.7) and summaries (Tables 4.1.1 and 4.1.2) below to provide context for SAH data. The maps show numbers of incorporated community groups by suburb, and the percentage of incorporated community groups that cater wholly or partly to CALD groups.

The number of incorporated community groups within Brimbank is impressive, at 689; 200 of these are in St Albans. Of the identified incorporated community groups, 44% could be classified as wholly or partly targeted at CALD groups, for example, cultural or linguistic groups for sport or for the elderly.

The composition of community groups suggest a need for belonging with 'people like us' or for communities of interest. The preponderance of community groups in St Albans and Sunshine PHAs are consistent with the ethnic make-up of those subpopulations.

The City of Brimbank's statistics on religious groups provide additional indicators of cultural identity and ethnicity when observed in conjunction with key variables, and are reflected in the community groups.

15 Victorian Women's Health Atlas 2015 http://victorianwomenshealthatlas.net.au/#!/

16 The list of incorporated community groups was unable to be used in correlations because locality/suburb boundaries do not coincide exactly with PHAs (particularly St Albans), and the list did not include Deer Park or Cairnlea (these absences would skew correlation results).

4.2 Obesity

4.2.1 Summary box

Obesity is a national public health problem, but varies by location, socio-economic status and gender. Females in particular areas of Brimbank have very high rates of obesity.

This section considers both contextual information (from demographic, social, and health data) and social and physical infrastructure.

Contextual data

The highest rates of female obesity in Brimbank are in the areas of greatest socio-economic disadvantage.

Male and female obesity rates have different patterns. Male obesity is prevalent across a broader socio-economic spectrum and varies little across the different Brimbank PHAs.

Female obesity rates within Brimbank are strongly associated with socio-economic disadvantage and with health and wellbeing indicators, such as living with a disability, self-assessed poor or fair health, diabetes, harmful alcohol use, and psychological distress.

Newly available data for Brimbank show that 34.4% of children (two to 17 years) are overweight or obese, compared to an average of 25.8% nationally (2014–15).

Infrastructure data

Areas with high estimated rates of female obesity in Brimbank have less access to commercially operated gyms, and in particular to gyms run by or for women. This is an example of spatial inequality both reflecting and reinforcing health inequality. Municipal facilities, such as the St Albans Leisure Centre, are crucial infrastructure resources.

Female obesity rates are also inversely correlated with trees and public open space. This is, in part, a reiteration of the connection to socio-economic disadvantage.

An understanding of the gendered nature of perceptions of safety is important when considering physical activity. Women in Brimbank are much less likely than men to feel safe walking at night.

Major supermarkets and shops selling fruit (a proxy for fresh food availability) are located across the municipality, with many fresh food outlets in St Albans (an area of relatively high socio-economic disadvantage). However, take-away food outlets are more prevalent than shops selling fruit. Few areas in Brimbank are far from a take-away outlet, and their sheer ubiquity throughout the community is a feature in itself.

Some clusters of residential addresses in Brimbank are over 2 km from a major supermarket. In these cases, distance may be a factor in access to healthy food.

4.2.2 Obesity

The *Brimbank Atlas of Health and Education* (2014) presents estimates[17] of obesity rates by PHA in Brimbank. Obesity (in adults aged 18 years and over) was defined as a body mass index (BMI) of 30 or greater.

The *Atlas* reports that:

- **25.8% of men** in Brimbank are estimated to be obese, 6% below the national average, but slightly higher than the overall rate in Melbourne (23.7%).
- Male obesity rates vary little across PHAs in Brimbank, especially when compared to female obesity.
- The highest estimated rate of male obesity was in the St Albans – North/Kings Park PHA, at 26.7%. However, the lowest estimated rates of male obesity in Brimbank were not very different from the highest rates: these were in the PHAs of Cairnlea (25.1%), Ardeer –Albion/ Sunshine/Sunshine West (25.1%), and Taylors Lakes (25.1%).
- **32.6% of women** in Brimbank were estimated to be obese, versus the national rate of 27.6%, and the Melbourne rate of 26.0%.
- Female obesity rates showed significant geographic variation across PHAs in Brimbank.
- The highest rate was in the St Albans – North/ Kings Park PHA, with 41.6% of adult females estimated to be obese – over 1.5 times the national rate.
- The lowest rate was in the Keilor PHA, with 22.4% of adult females estimated to be obese – almost a fifth lower than the national rate.

Maps 4.2.1–4.2.14 show general obesity and female and male obesity data for Brimbank and Melbourne, for Brimbank's PHAs, and overlays of key indicator data.

More recent data for childhood overweight and obese (two to 17 years) in Brimbank have been made available from the *Australia's Health Tracker by Area*, 2017 (see Table 4.2.2 page 87).

Given that being overweight or obese is a critical risk for later life the next stage of work involves the mapping of obesity's correlations with physical and social infrastructure *specifically for this age group.*

17 Rates were estimated by the Australian Bureau of Statistics, from the *2010 General Social Survey* and from the *Australian Health Survey 2011–13*. Refer to the data descriptions in Appendix C of *The Brimbank Atlas of Health and Education* (2014), p. 157.

4.2.3 Correlations at Brimbank Population Health Area level

There are no significant positive correlations at Brimbank PHA level for presence or absence of physical and social infrastructure and high estimated rates of male obesity
Health and wellbeing indicators People aged under 65 living with a disability (.768**) Estimated rates of self-assessed poor or fair health (.653*) **Contextual indicators** Percentage of single-parent families (.670*) **Education and child development** Rates of early school leavers (.699*)

Estimated Rates of MALE Obesity
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high rates of male obesity
Physical and social infrastructure Bike paths, off road – proximity to residences (-.744*) Streams and rivers – proximity to residences (-.729*) Late-opening GPs – per person (-.010) **Health and wellbeing indicators** [no significant results] **Contextual indicators** [no significant results] **Education and child development** [no significant results] **Demographics** [no significant results]

Estimated Rates of FEMALE Obesity
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high estimated rates of female obesity
Physical and social infrastructure Cultural supermarkets – per person (.817**) State primary schools – per person (.687*) Packaged liquor licenses – proximity to residences (.638*) Late-opening GPs – proximity to residences (.461)
Health and wellbeing indicators People aged under 65 living with a disability (.916**) Estimated rates of self-assessed poor or fair health (.900**) Estimated rates of diabetes (.881**) Estimated rates of male smokers (.870**) Estimated rates of harmful alcohol use (.829**) Estimated rates of psychological distress (.787**)
Contextual indicators Socio-economic disadvantage (.859**) Percentage of jobless families (.856**) Dwellings in mortgage stress (.808**) Percentage of single-parent families (.807**) Dwellings with no motor vehicle (.735*) Percentage born in NES country (.722*)
Education and child development Rates of early school leavers (.818**)

Estimated rates of FEMALE obesity
Inverse Correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high estimated rates of female obesity
Physical and social infrastructure Trees [open space] – per person (-.799**) Percentage of parkland (-.746*) Trees [street] – per person (-.707*) Fitness businesses [all] – per person (-.700*) Contour variation (-.697*) Playgrounds [all public] – per person (-.675*) Gyms – per person (-.661*) Women's gyms – per person (-.656*) Playgrounds [flagship] – per person (-.642*) Drinking fountains – per person (-.637*) Late-opening GPs – per person (-.152) **Health and wellbeing indicators** [no significant results] **Contextual indicators** People engaged in voluntary work (-.706*) Percentage learning or earning aged 15 to 19 (-.661*) **Education and child development** Children developmentally on track – language and cognitive skills (-.672*) **Demographics [no significant results]**

4.2.4 Summary of the correlations

In the PHAs in Brimbank with higher estimated rates of **male obesity**, there were more people with self-assessed poor or fair health and more people aged under 65 years living with a disability, associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

Infrastructure

- Greater distances from off-road bike paths, rivers and streams.

Context

- Higher proportions of early school leavers.

In the PHAs in Brimbank with higher estimated rates of **female obesity**, there were higher estimated rates of self-assessed poor or fair health, diabetes, male smokers, harmful alcohol use and psychological distress, associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

Infrastructure

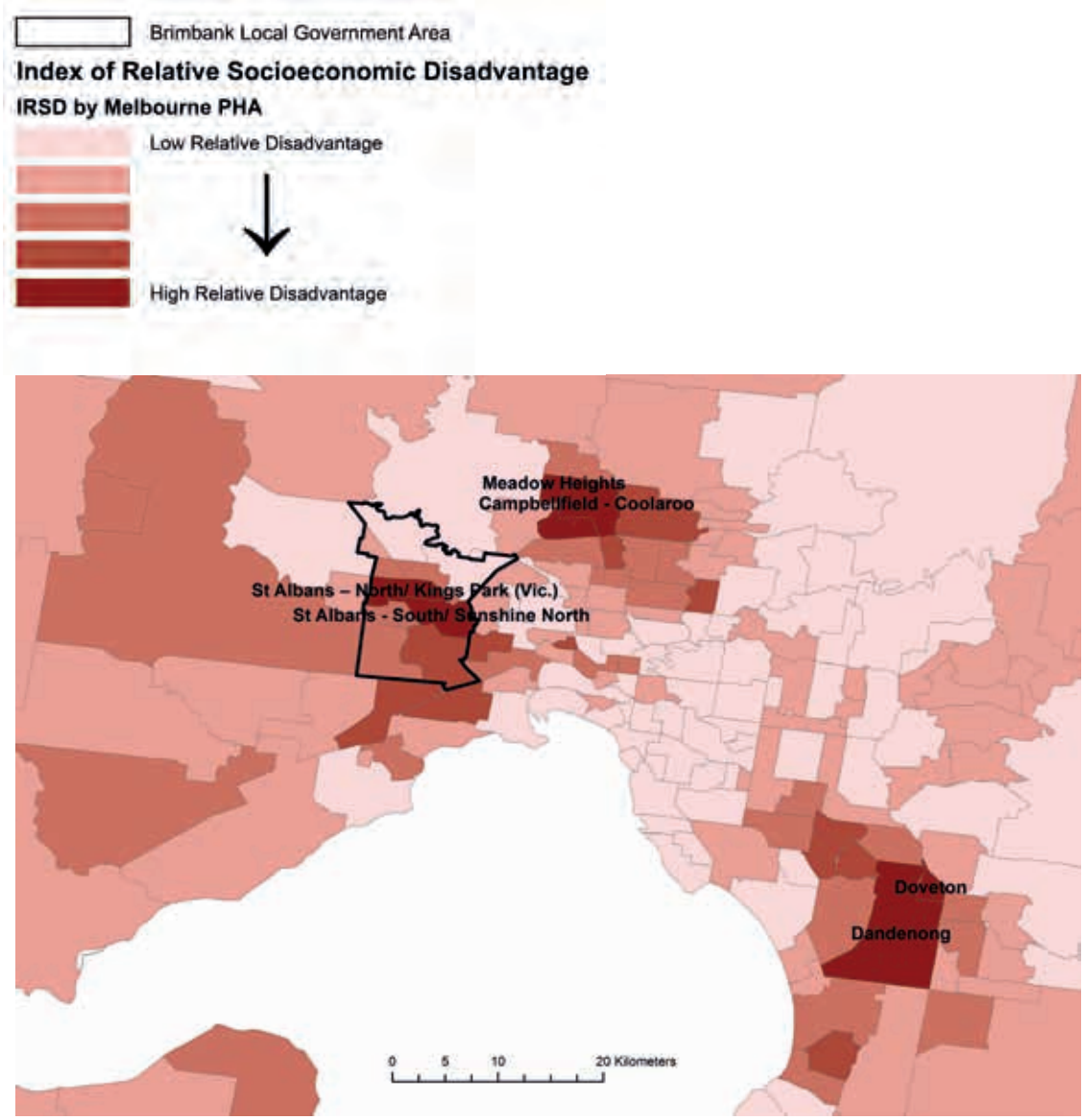
- Significantly greater proximity to packaged liquor licenses.
- Fewer trees, fewer fitness businesses, fewer gyms, fewer women's gyms, fewer playgrounds, and fewer drinking fountains per person.
- Less parkland.
- Fewer hills.

Context

- More people aged under 65 years living with a disability.
- Greater socio-economic disadvantage.
- Higher proportions of jobless families, dwellings in mortgage stress, and single-parent families.
- Higher proportions of early school leavers.

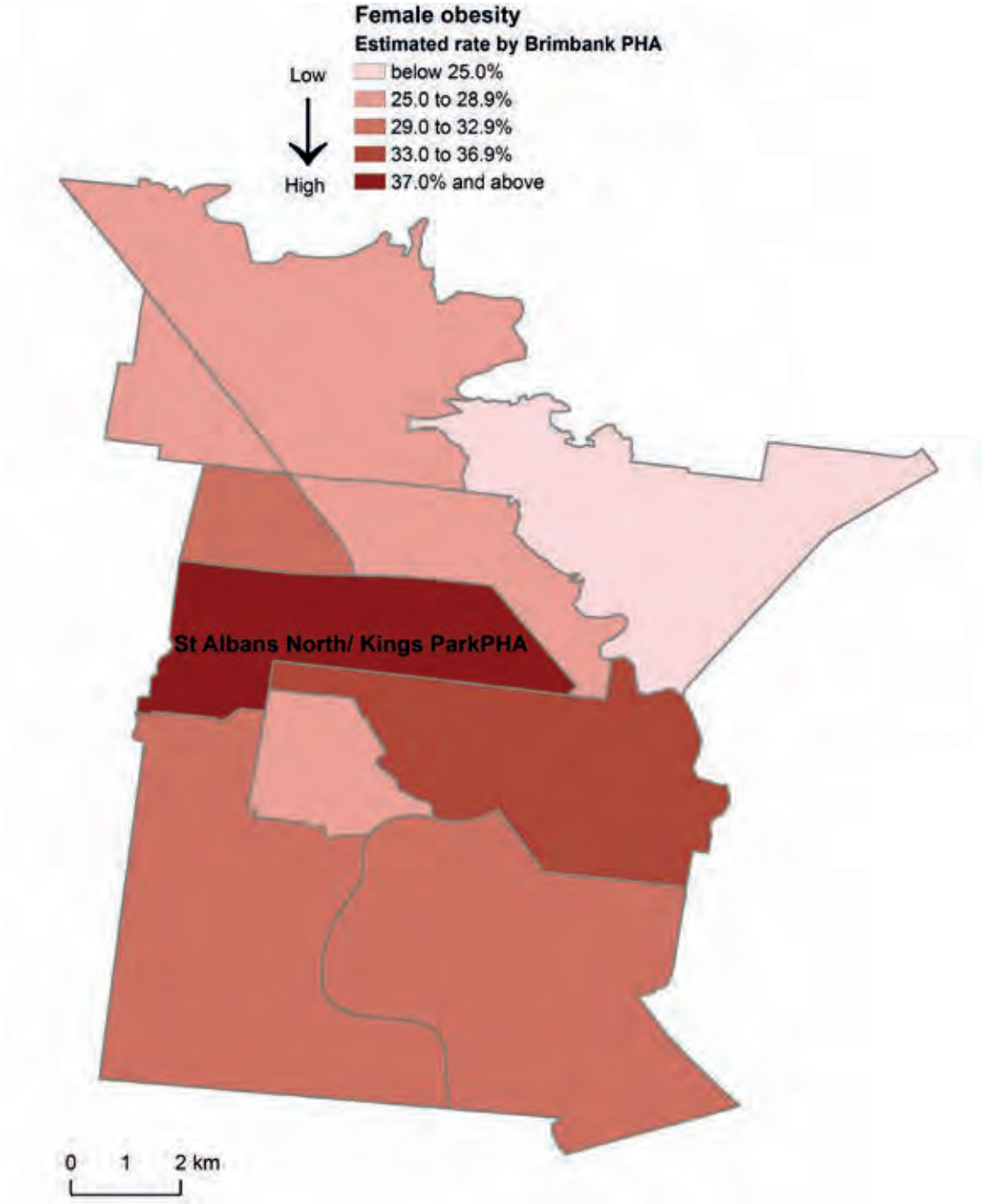
Take-away food outlets, fresh food outlets and sports facilities do not show any significant correlations with obesity at Brimbank PHA level. This may be due to the high numbers of these outlets throughout the community, which means that the relationship between various population characteristics and the numbers of food outlets does not stand out. The maps below (4.2.6–4.2.8) show the ubiquity of take-away food outlets throughout the community.

4.2.5 Maps



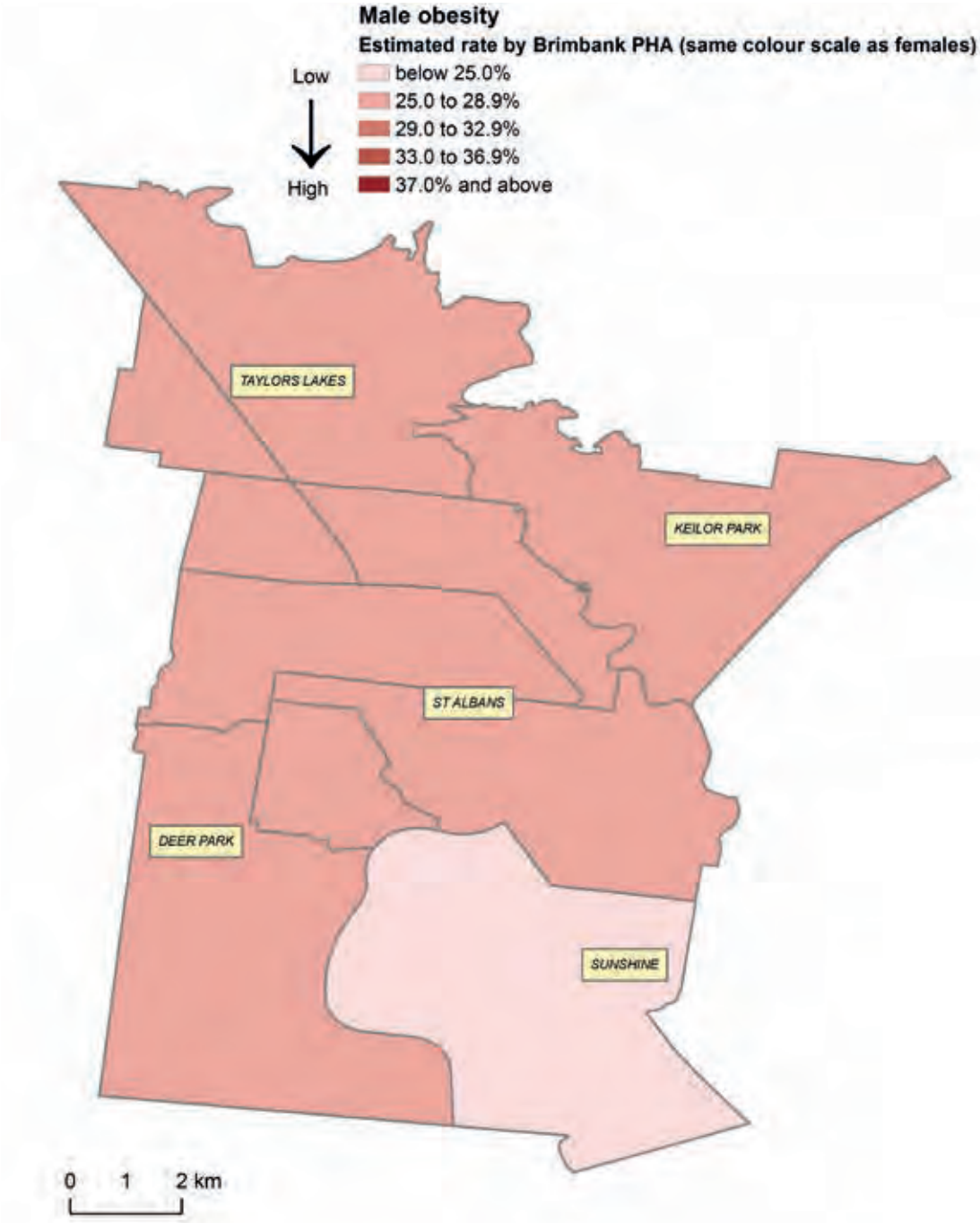
Map 4.2.1 Index of Relative Socio-economic Disadvantage by Melbourne PHA

Note the similarity to the pattern of estimated rates of female obesity (Map 4.2.5). The areas of highest socio-economic disadvantage (St Albans in Brimbank, Coolaroo in Hume, Thomastown in Whittlesea, and Dandenong) are also the areas with the highest estimated rates of female obesity.

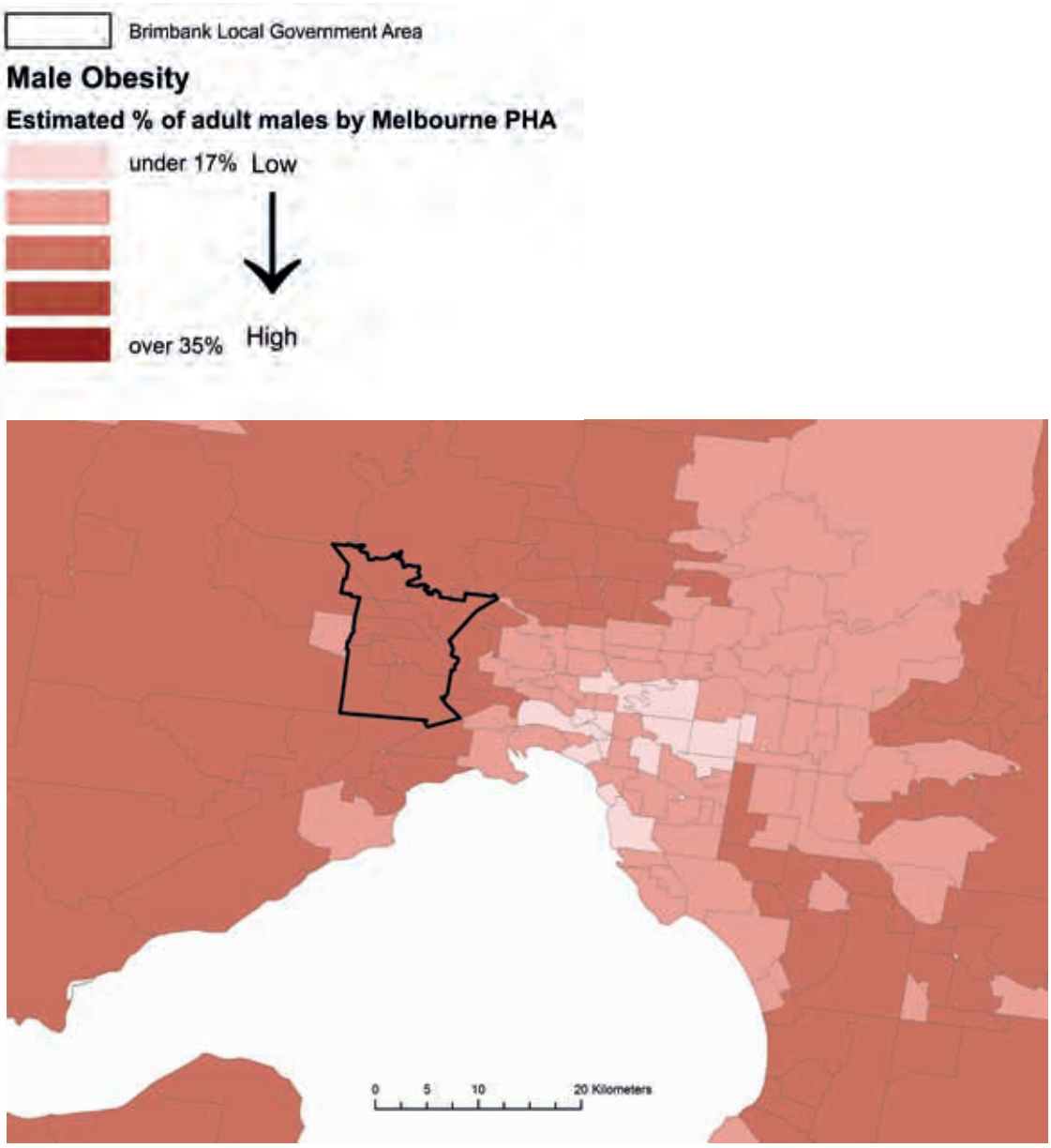


Map 4.2.2 Estimated rates of female obesity, by Brimbank PHA

Map style from page 121 in Brimbank Atlas

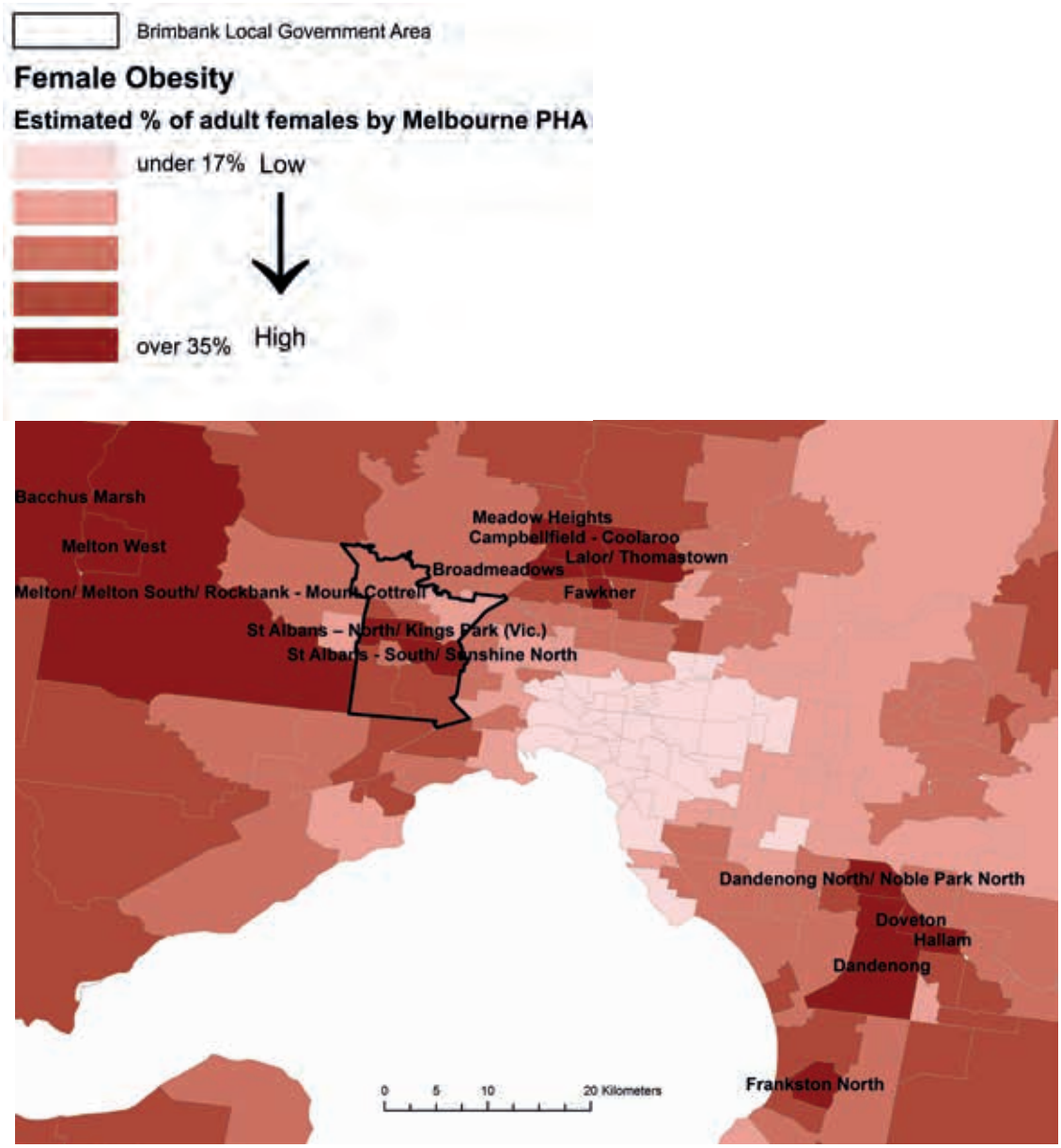


Map 4.2.3 Estimated rates of male obesity, by Brimbank PHA



Map 4.2.4 Estimated rates of male obesity by Melbourne PHA

This map uses the same colour scale as the map for estimated female obesity rates below. At this Melbourne-wide scale, the minimal variation in estimated male obesity rates within Brimbank is evident; nonetheless a broad pattern exists, with higher rates at greater distances from the city centre, except in the eastern suburbs.



Map 4.2.5 Estimated rates of female obesity by Melbourne PHA

The inner and eastern PHAs in Melbourne show consistently low estimated rates of female obesity. The pattern of IRSD in Melbourne is similar (see Map 4.2.1).

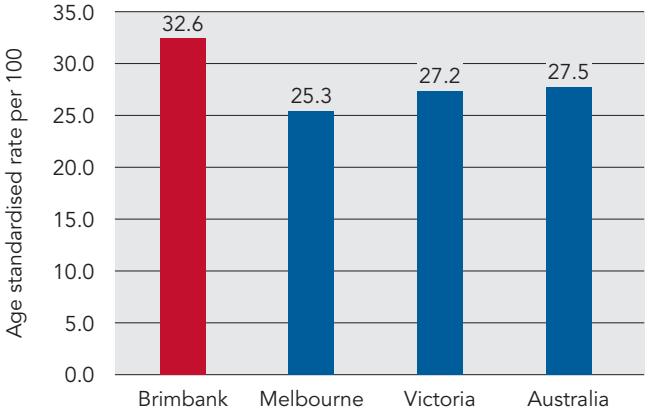


Figure 4.2.1 Comparison of Brimbank with average estimated population of obese adult females in Greater Melbourne, Victoria and Australia, 2011–12

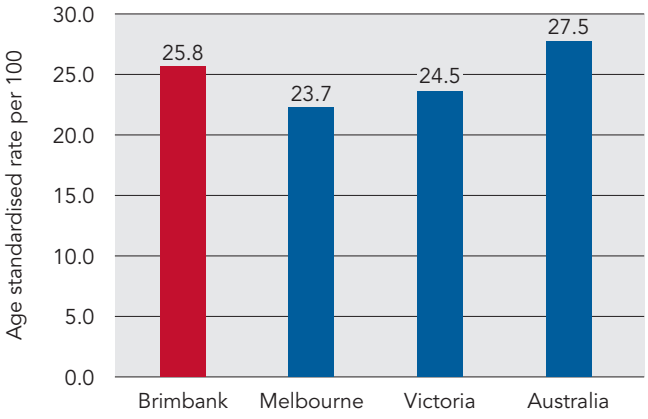


Figure 4.2.2 Comparison of Brimbank with average estimated population of obese adult males in Greater Melbourne, Victoria and Australia, 2011–12

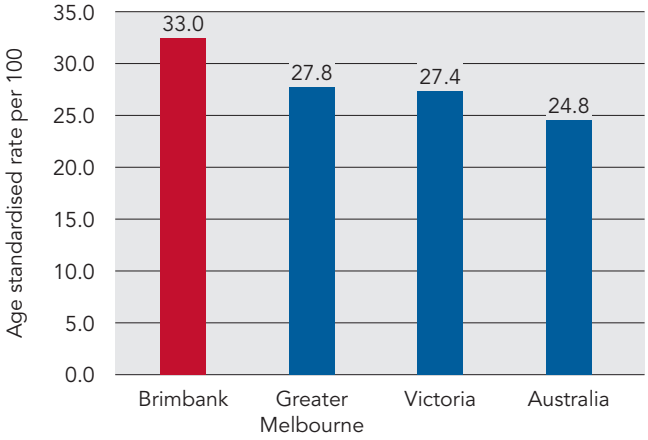


Figure 4.2.3 Comparison of Brimbank with average estimated population of obese or overweight 2–17-year-old females in Greater Melbourne, Victoria and Australia

[NB these data are for 2014–15]

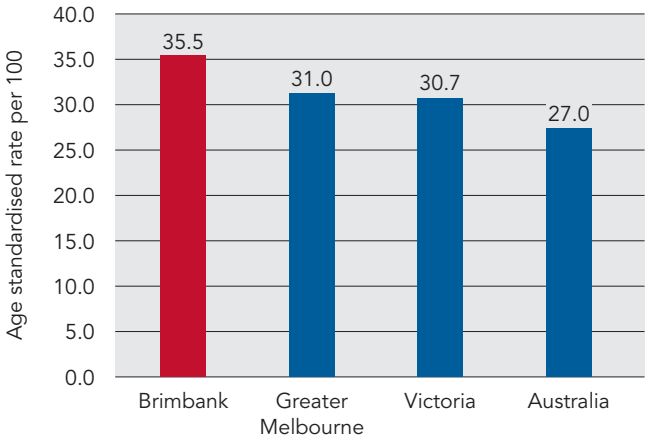
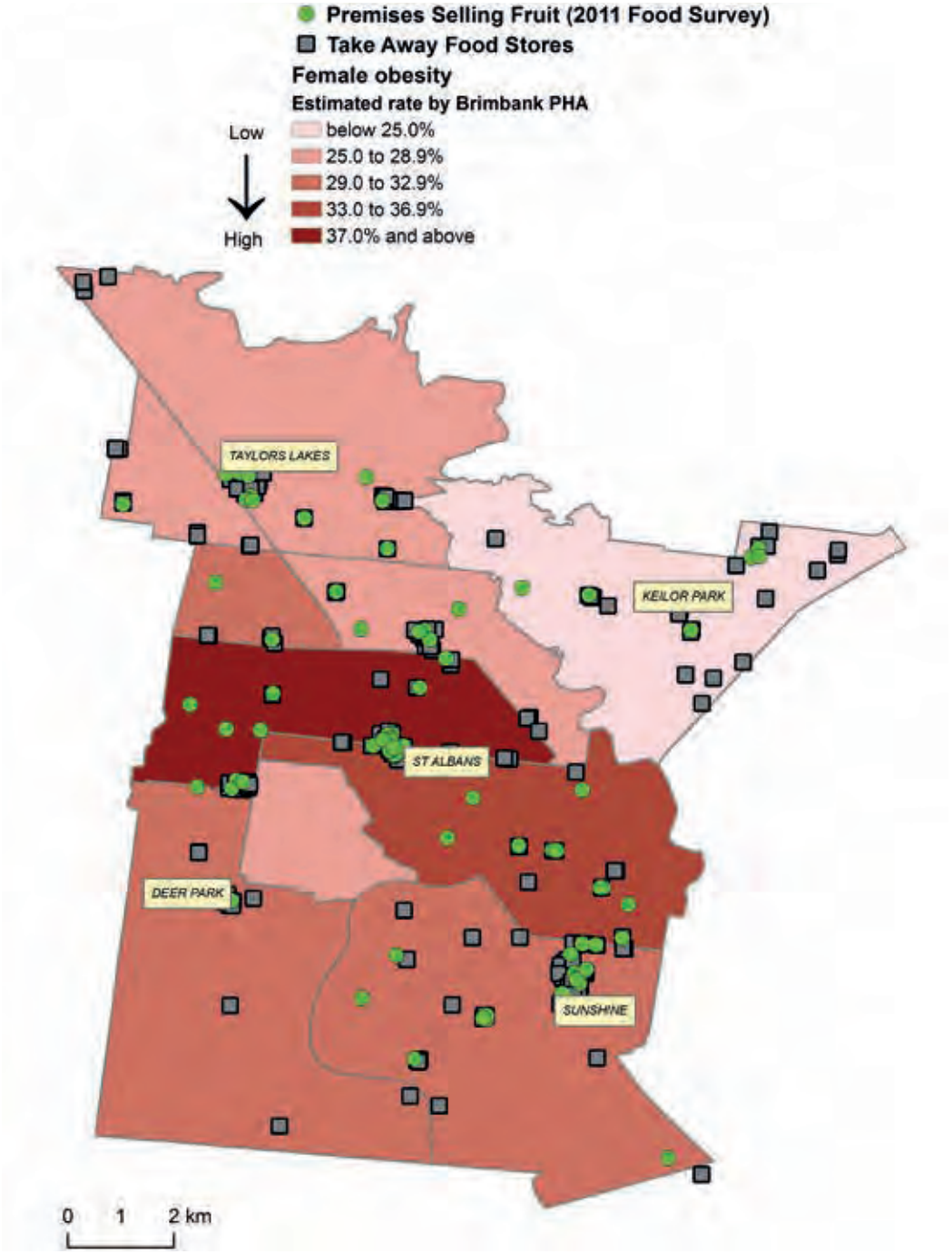


Figure 4.2.4 Comparison of Brimbank with average estimated population of obese or overweight 2–17-year-old males in Greater Melbourne, Victoria and Australia

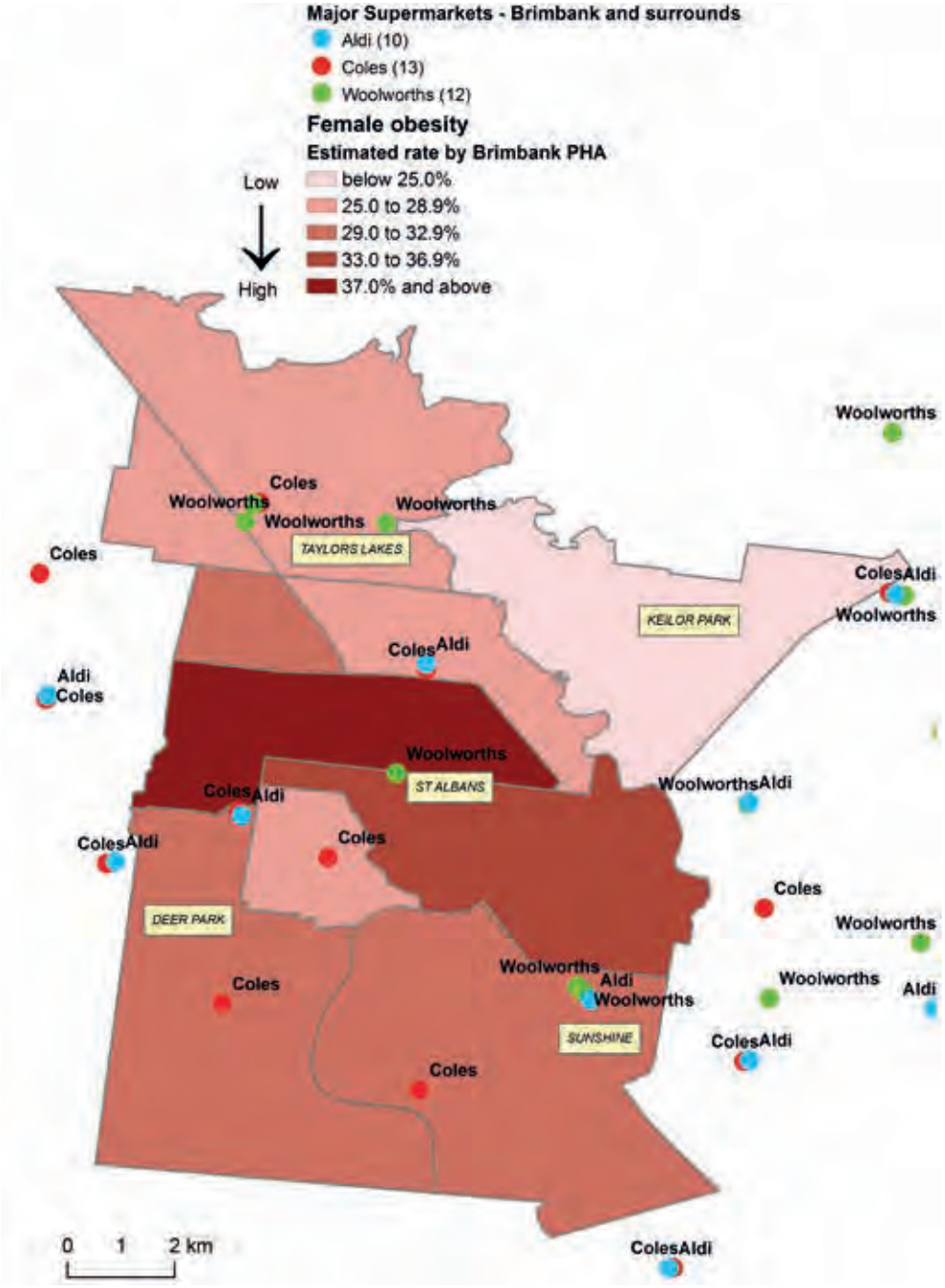
[NB these data are for 2014–15]



Map 4.2.6 Estimated rates of female obesity in Brimbank PHAs

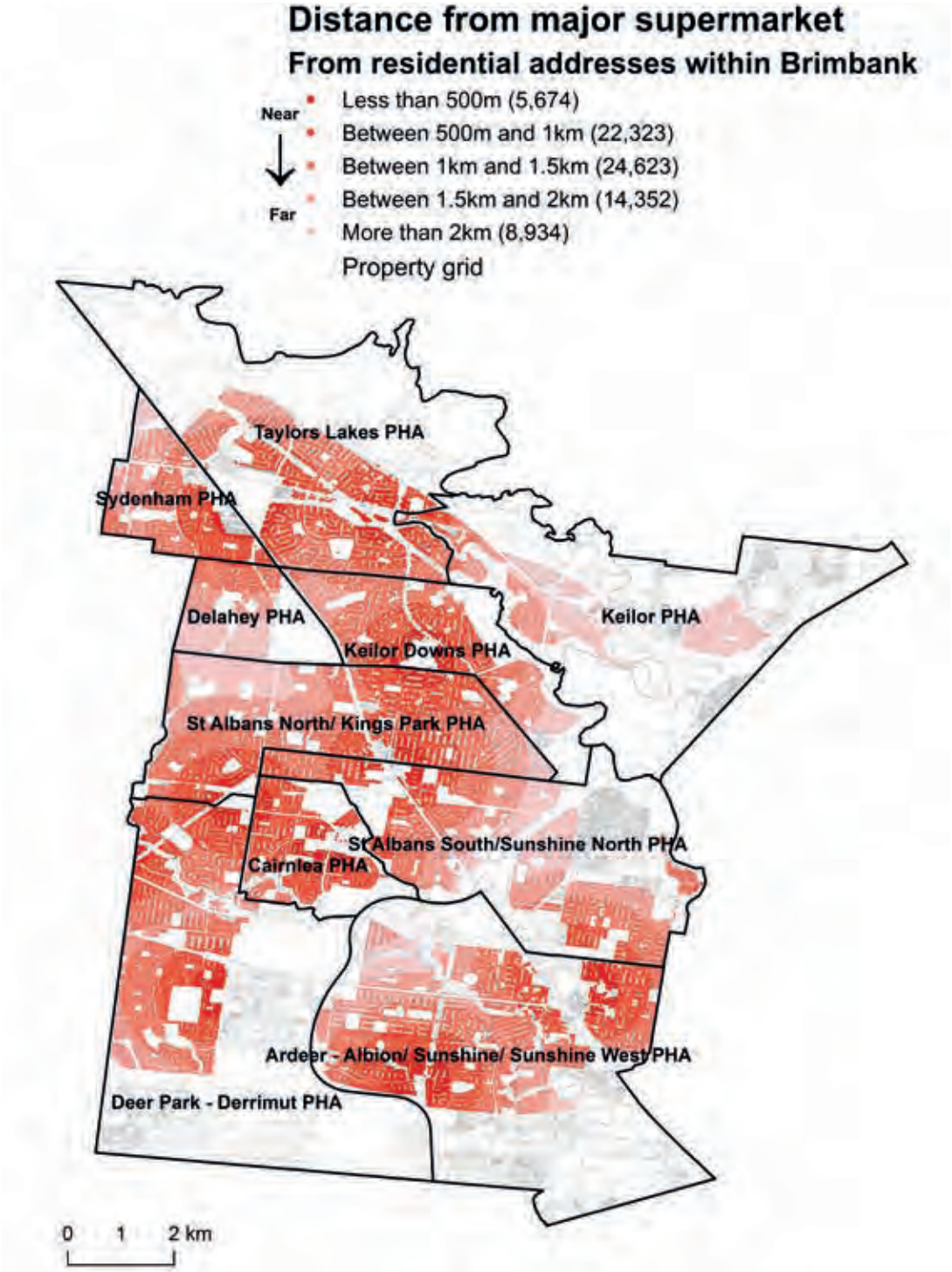
Overlays of premises selling fruit (green) and take-away food stores (grey). Both food datasets are from the Brimbank 2011 food survey.

Note that there is no obvious shortage of premises selling fruit (a proxy here for fresh food availability). These are found throughout Brimbank, and there are many in St Albans. However, take-away food stores are more widely distributed throughout the community.



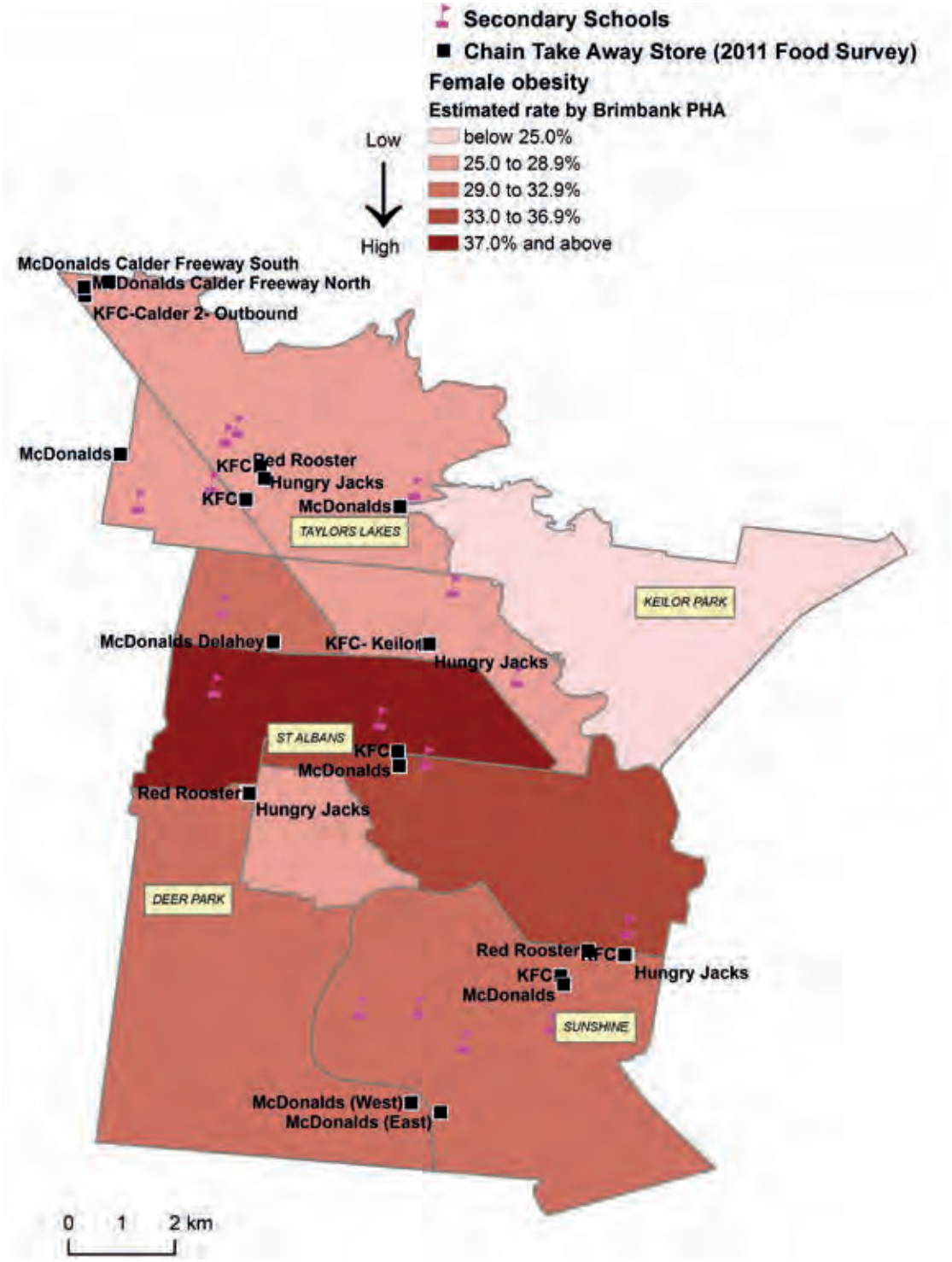
Map 4.2.7 Estimated rates of female obesity in Brimbank PHAs

Overlay of major supermarkets. Note that there are numerous major supermarkets in and around Brimbank, but some areas have relatively less access, as shown in more detail in Map 4.2.8.



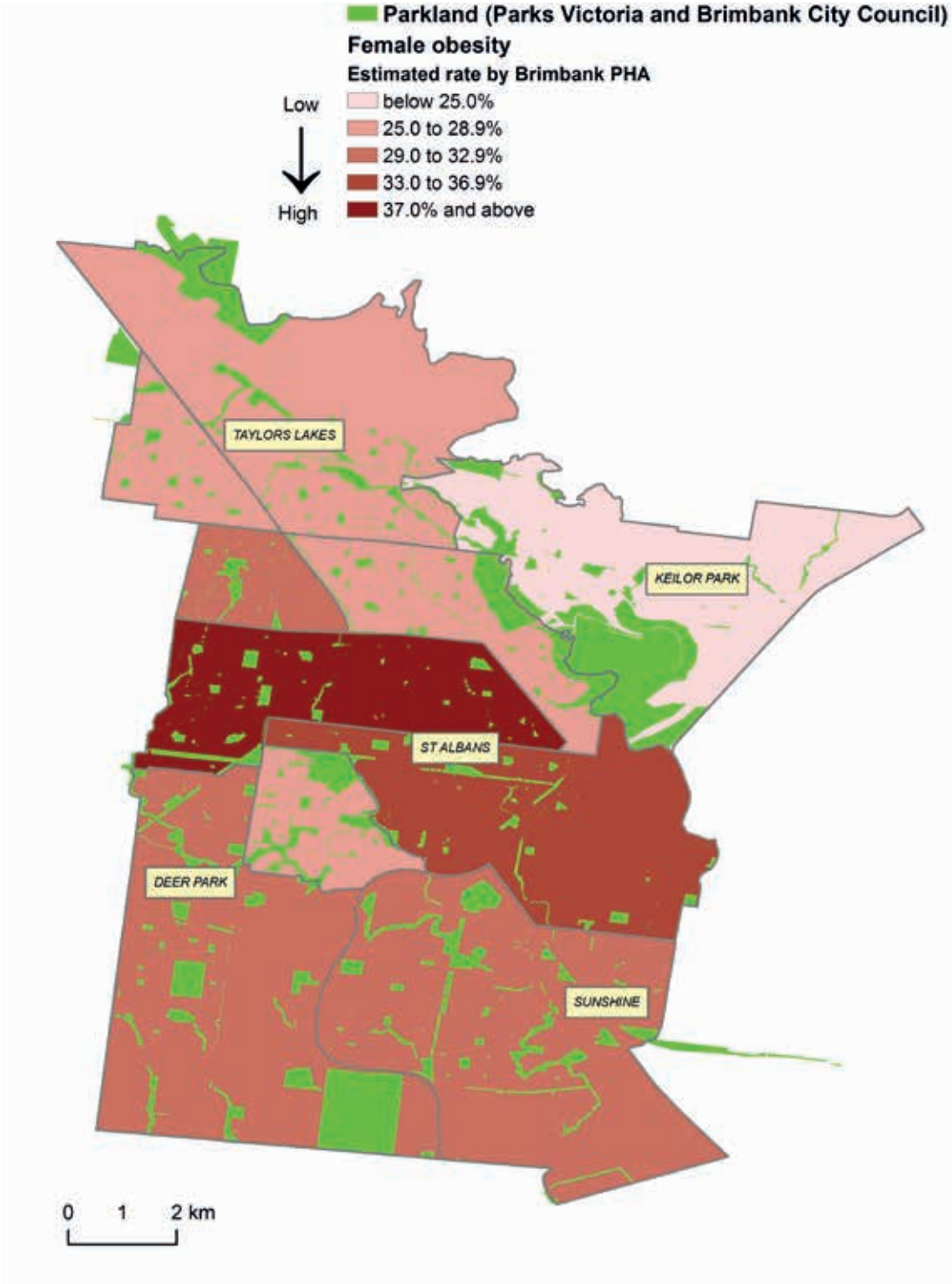
Map 4.2.8 Distance to major supermarkets from residential addresses in Brimbank

Note that a small proportion of residences are relatively far from major supermarkets (12% of residential addresses are more than 2 km from a major supermarket).



Map 4.2.9 Estimated rates of female obesity in Brimbank PHAs

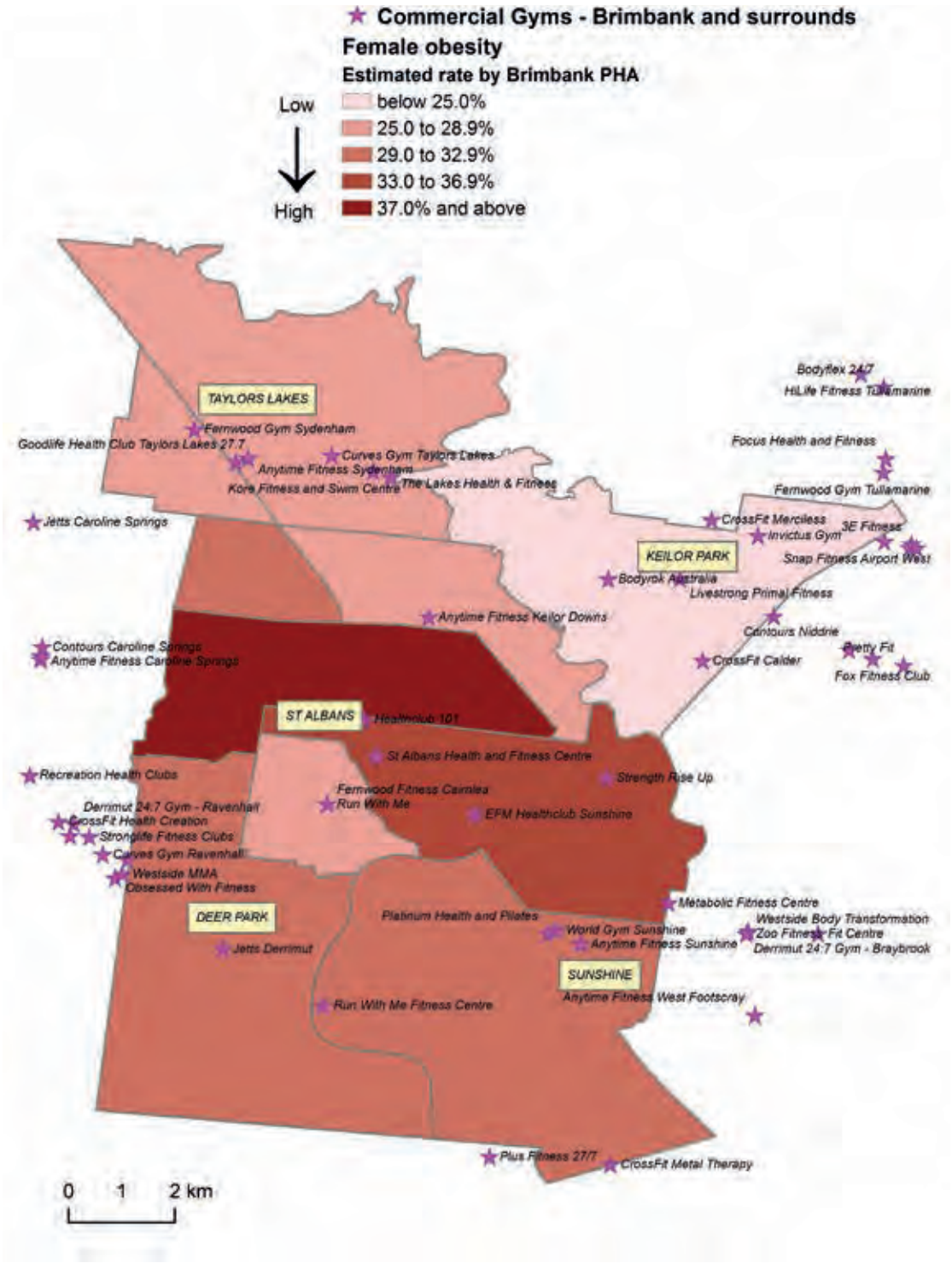
Overlay of chain take-away outlets (as labelled), and secondary schools. Half the secondary school campuses in Brimbank are within 800 m of a chain take-away outlet.



Map 4.2.10 Estimated rates of female obesity in Brimbank PHAs

Overlay of parkland

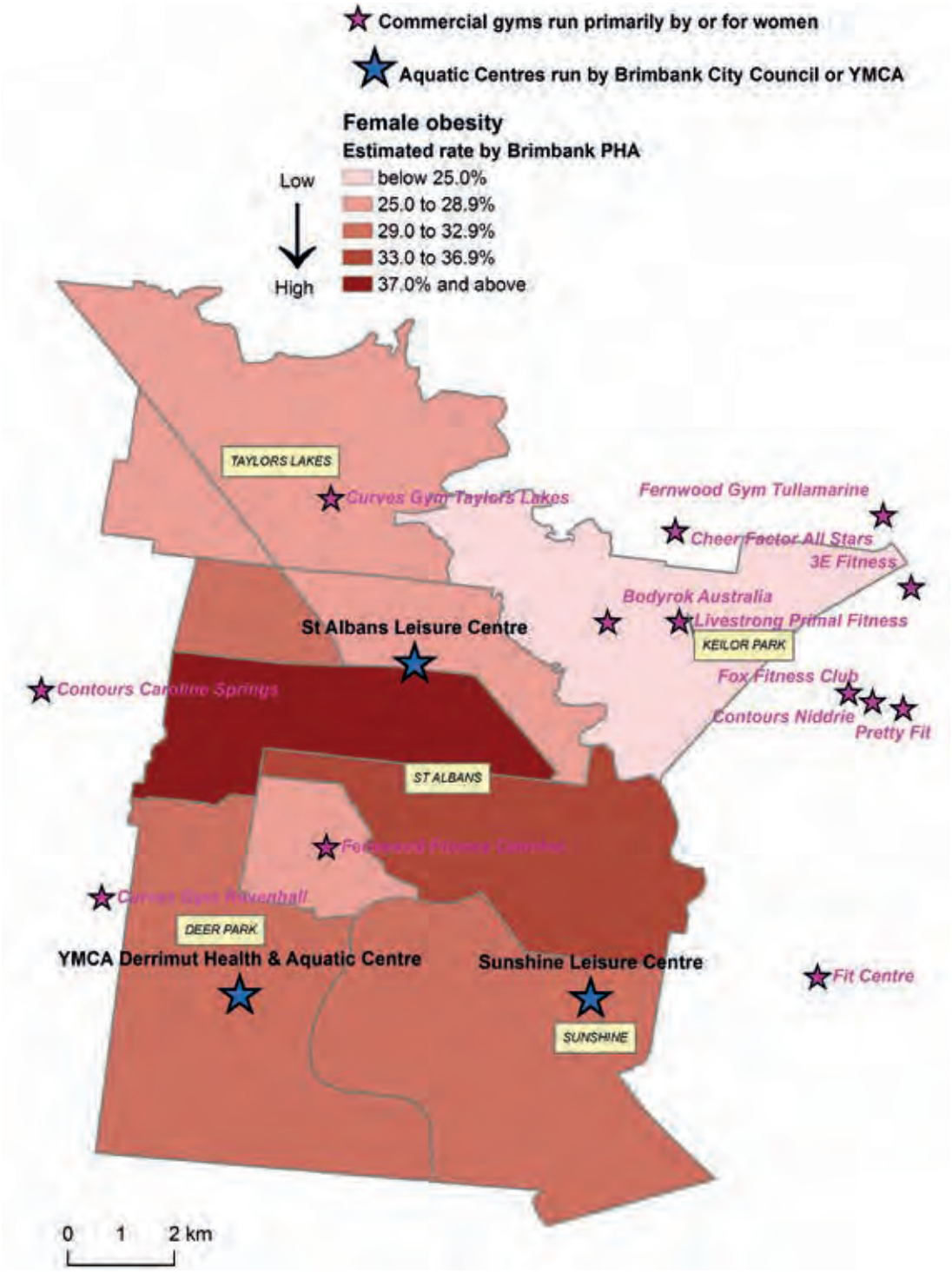
The inverse correlation between female obesity and parkland as a proportion of suburb area is striking.



Map 4.2.11 Estimated rates of female obesity in Brimbank PHAs

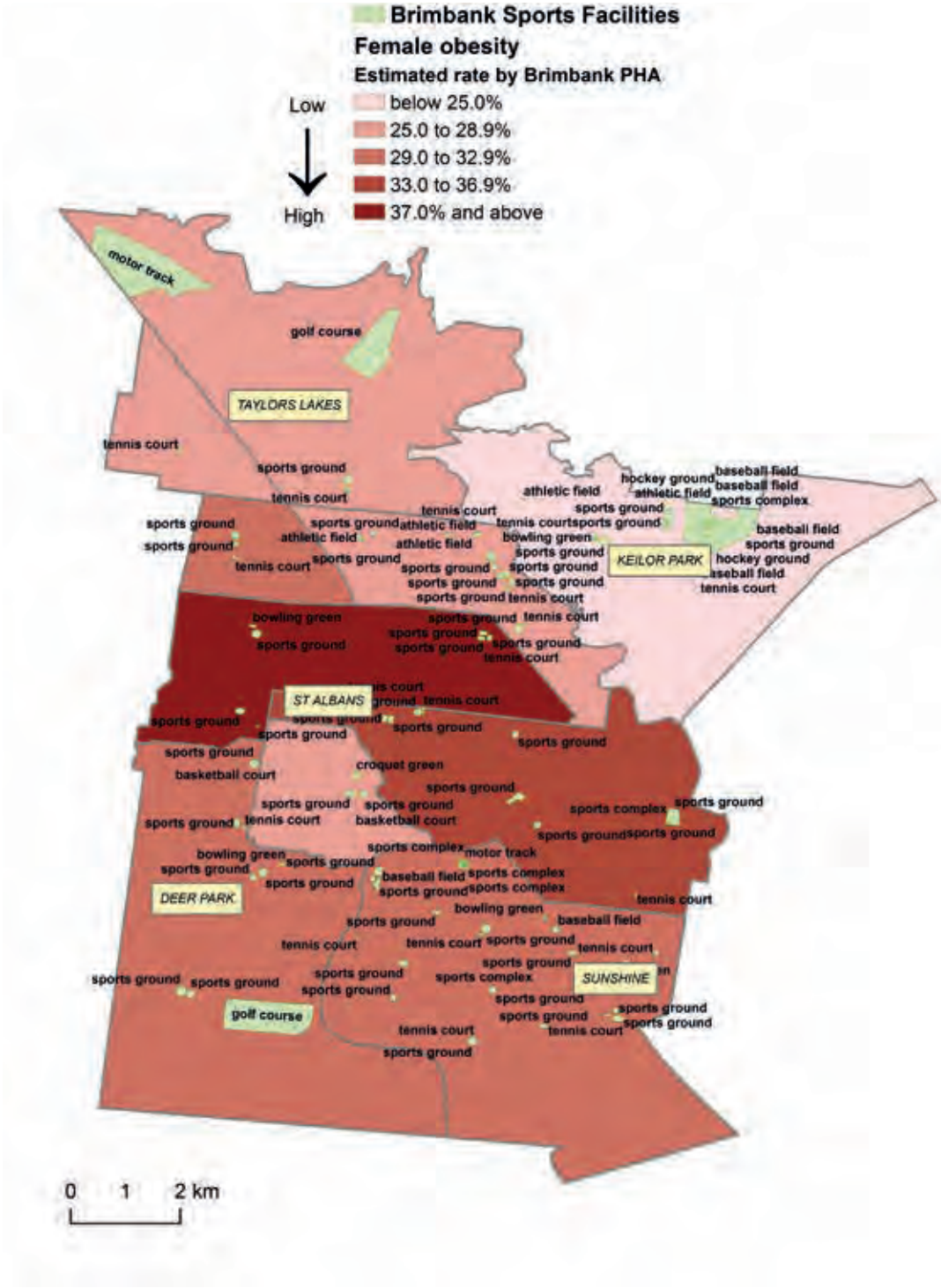
Overlay of commercial gyms

Note that there are few or no commercial gyms in areas of high female obesity.



Map 4.2.12 Estimated rates of female obesity in Brimbank PHAs

Overlays of aquatic centres run by Brimbank City Council or YMCA (blue stars) and commercial gyms run primarily by or for women (pink stars). The not-for-profit aquatic centres are located in areas that contain no commercial providers.



Map 4.2.13 Estimated rates of female obesity in Brimbank PHAs

Overlay of sports facilities (sports grounds, golf courses, bowling greens, tennis courts, as per labels)

The City of Brimbank had the lowest density of playing fields and courts for seven major sports (3.2 facilities per 10,000 persons in Brimbank, Melbourne 5.7, Victoria 9.0) in 2012. The highest rate of facilities per person in Brimbank in 2012 was in Keilor (Table 4.2.1).

PHA	Number	Rate*
Ardeer - Albion/Sunshine/ Sunshine West	29	8.4
Cairnlea	3	3.1
Deer Park - Derrimut	18	7.3
Delahey	3	3.4
Keilor	34	39.5
Keilor Downs	10	7.1
Kings Park/St Albans North	5	1.5
St Albans South/ Sunshine North	13	4.6
Sydenham	7	5.7
Taylors Lakes	13	7.0
Brimbank City	**135**	**7.0**

ˆ In seven major sports
* Fields/courts per 10,000 persons

Table 4.2.1 Playing fields and courts for seven major sports by PHAs in Brimbank City, 2012

(source: *Physical Activity, Sport and Health in the City of Brimbank* , 2014, page 41).

Indicator	National average (%) 2014/2015 estimates	Brimbank (%) 2014/2015 estimates
Overweight and obese persons (2 to 17 yrs)	25.8	34.4
Overweight or obese boy	28.1	37.3
Overweight or obese girls	23.6	31..4
Obese persons	7.5	10
Obese boys	7	9.4
Obese girls	8.1	11.4

(NB source ABS data 2014-2015 estimates)

Table 4.2.2: Estimated percentages of overweight or obese children (2–17 years) in Brimbank and Australia.

NB the modelled estimates are based on the 62.3% of children in the sample who had their height and weight measured. Cross-reference to Figures 4.2.1 to 4.2.4 comparing estimated rates in 2–17-year-olds in Brimbank with average rates for greater Melbourne, Victoria and Australia.

4.2.6 Discussion

Obesity is a complex and multifaceted public health issue. Its patterns are social and economic, gendered and spatial. All four of these patterns combine in Brimbank, as the highest rates of obesity in women are found in areas of highest socio-economic disadvantage. However, there is not quite a simple equation of *disadvantage = obesity*.

Female obesity was included in Section 3 of this report as part of an introduction to the possibilities and also the complexities of using GIS with public health research. At a national level, there is a positive correlation between socio-economic disadvantage and rates of female obesity, but it is not strong. Other factors play a role, and they are difficult to untangle, as is demonstrated by the wealth of literature on the topic (Burns 2004, Jones et al. 2007, Lakerveld et al. 2016, Moodie & Taylor 2012), and the fact that several international research journals are dedicated solely to the topic of obesity.

Australia has met very few of its national obesity reduction targets (Moodie et al. 2016). *Australia's Health Tracker*, developed by a national collaboration of Australia's leading chronic disease experts, clinicians and researchers (AHPC 2016), sets a national target to lower the prevalence of overweight and obesity to 61.1% by 2025. This would reduce the percentage of people in the population who are obese to 24.6%, returning to the 2007–08 level.

Hence, although Brimbank is not unusual in facing obesity issues, its high prevalence of obesity (for women, 18% above the Australian average) presents a particular health and wellbeing challenge.

Socio-economic disadvantage

Since the late 20th century, high rates of obesity in industrialised nations have been associated with socio-economic disadvantage. Being poorer is more likely to mean being overweight or obese than being thinner:

> *Intuitively any relationship between poverty, food insecurity and obesity would appear an unlikely contradiction. How can someone have little money and therefore restricted food intake and still be obese? However … literature in both peer-reviewed and government publications indicates a strong relationship between poverty and obesity … National and international data indicate that those with the poorest social, economic and educational resources are at the greatest risk of obesity. (Burns 2004, p. 5)*

This link is reflected in the Brimbank data: the PHA with the highest estimated obesity rate (for both men and women) is also the one with the greatest socio-economic disadvantage: St Albans / Sunshine North.

Physical exercise and the availability of suitable facilities is another important factor in obesity. This report shows that socio-economically disadvantaged areas of Brimbank have few commercial fitness providers, particularly those that cater specifically for women. In contrast, not-for-profit recreational services are well placed: aquatic centres run by the YMCA or Brimbank City Council and sports fields are in areas in which commercial fitness businesses are less prevalent (but in which bottle shops and take-away food outlets are plentiful).

Obesogenic environments

Obesogenic environments are environments that do not support good public health because they present barriers to physical activity and a healthy diet (Swinburn et al. 1999). Extensive reviews of literature relating to obesogenic environments have been conducted by the European SPOTLIGHT project[18] and by the UK Government Office for Science (Jones et al. 2007, Mackenbach et al. 2014).

The UK Government Office for Science review divided literature on obesogenic environments into two categories:

1. **The environmental determinants of food availability**

   For example, measuring cost and proximity of healthy food in comparison to low-quality food (Hilmers et al. 2012, Kestens et al. 2010, Sharkey et al. 2009; Ward et al. 2013).
2. **The environmental determinants of physical activity and obesity**

These literature categories are relevant to discussion in this report, although again it should be noted that obesity is a complex research area for which this report only provides some local context.

Food availability

Fresh food is available in many parts of Brimbank. There are no correlations at Brimbank PHA level between obesity and the proximity or prevalence of fresh food outlets.

While fresh food is accessible throughout Brimbank, takeaway food stores are ubiquitous, as shown in map 4.2.6. As a result, there are few correlations with take-away outlets at Brimbank PHA level simply because they are so evenly distributed. Few residences are far from a take away-food store (Map 4.2.6).

The term 'food deserts' refers to areas where fast food and packaged food are more accessible than healthy food (Beaulac et al. 2009, Cummins 2014). Brimbank is obviously not a food desert, but there are some points of concern – residential areas located far from supermarkets, and the ubiquity of take-away food outlets.

There are more major supermarkets in the north and south of Brimbank than in the centre. Map 4.2.8 shows distance to supermarkets from residential addresses. There is only one major supermarket in central St Albans, and residential pockets of St Albans, Sunshine North, Kings Park and Delahey are more than 2 km from a major supermarket.

18 SPOTLIGHT (standing for sustainable prevention of obesity through integrated strategies) is a cross-European research project. It is funded by the European Commission through its seventh Framework programme. www.spotlightproject.eu

Given the cultural composition of Brimbank, a further consideration in food availability is access to cultural supermarkets. Map 4.4.4 (as part of section 4 – psychological distress) shows cultural supermarkets are concentrated in St Albans, but are by no means plentiful.

Gender and physical activity

The Physical Activity, Sport and Health in the City of Brimbank report presented data on sports groups in combination with *The Brimbank Atlas of Health and Education* data, in a comparable manner to this report (Eime et al. 2014a). It noted that rates of participation in formal sport were relatively low in Brimbank, as well as in physical activity more generally.

The report found that participation in **leisure-time physical activity** (PA) is associated with lower prevalence of overweight and obesity. When participation in **leisure-time PA was coupled with sport** the effect extended to other health outcomes including diabetes, child development vulnerability in the domains of physical health and wellbeing, social competence, emotional maturity, language and cognitive ability, communication and general knowledge, and lower prevalence of psychological distress. Maps 4.2.10 to 4.2.14 provide information about access to parkland and facilities that support physical activity.

However, participation in formal sport was not associated with lower prevalence of overweight and obesity generally.

Overall participation rates in PA and sport in the Brimbank community are relatively low. Further, the community is not well provided with facilities for sport and physical activity participation.

The association between participation in leisure-time PA and sport and better overall (all-age) health outcomes was stronger for participation among younger age groups (<20 years) than for participation among older age groups.

Wider literature indicates that participation in formal sports drops with age, and drops more for women. Participation rates are high for both genders in children, but from adolescence they split considerably (Eime et al. 2013, Eime et al. 2014b). Hence, infrastructure for formal sports facilities is likely to be utilised by more men than women, and overall by a small percentage of the community.

Brimbank City Council is developing a Physical Activity Strategy (2018) and is investigating barriers to physical activity in leisure time and to engagement in formal sport. The need for healthy environments is also reflected in the Brimbank City Council (2016), Cycling & Walking Strategy.

4.3 Diabetes

4.3.1 Summary box

The estimated prevalence of diabetes in Brimbank is 63% above the national figure. In some PHAs of Brimbank, the estimated diabetes prevalence is twice the national average.

Estimated diabetes rates within Brimbank are associated with many other health and wellbeing indicators (eg. obesity, self-assessed poor or fair health, and male smokers), and with other contextual indicators (eg. jobless families, socio-economic disadvantage, populations from backgrounds with English as a second language, and the number of cultural supermarkets).

The correlation between obesity and diabetes is significant. The physical and social infrastructure can affect the prevalence of both obesity and diabetes, and is therefore relevant to local policy and practice.

Diabetes rates in Brimbank differ from obesity rates in that:

a. the data are not gender-specific;
b. overall rates are lower; and
c. Sunshine PHA has a higher estimated diabetes rate than its obesity rate alone would suggest.

While several physical and social infrastructure associations are presented below, few stand out as being unique to diabetes. In particular, take-away stores are so prevalent in Brimbank that they do not return significant correlations at PHA level.

4.3.2 Diabetes

The Brimbank Atlas of Health and Education presents estimates[19] of diabetes mellitus rates in Brimbank, without differentiating between Type 1 and Type 2 diabetes. It notes that rates of diabetes within Brimbank are 63% above the national rate (8.8 per 100 people in Brimbank, versus 5.4 per 100 Australians).

Geographic variation was also noted between different PHAs in Brimbank (see Map 4.3.1).

The two highest rates are in the PHAs of St Albans – North / Kings Park, and St Albans – South / Sunshine North (both 11.2 people per 100 population). These rates are **over twice the national average**.

Several other PHAs in metropolitan Melbourne also show high rates of diabetes (see Map 4.3.2).

Maps 4.3.1–4.3.2 show diabetes data for Brimbank PHAs and Melbourne PHAs.

Map 4.3.3 shows the location of transport across the Brimbank area, highlighting access points to the features described in this section that may contribute to the obesogenic environment.

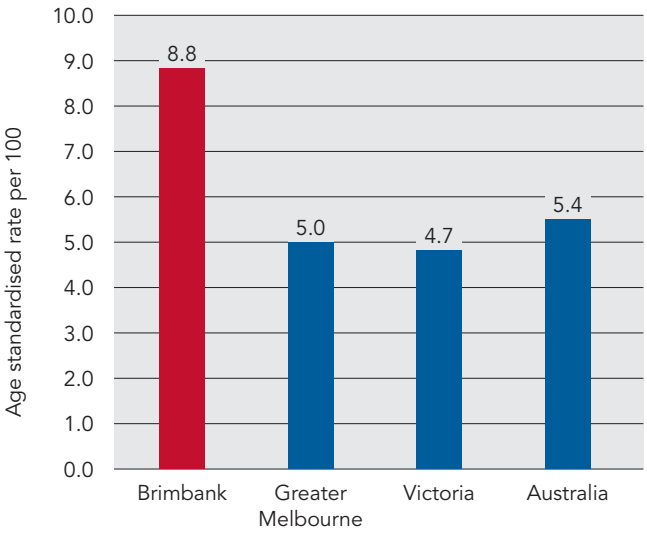


Figure 4.3.1 Estimated number of people aged 18 years and over with diabetes mellitus, 2011-2012

19 Rates were estimated by the Australian Bureau of Statistics, from the 2010 General Social Survey and from the Australian Health Survey 2011–13. Refer to the data descriptions in Appendix C of the Brimbank Atlas of Health and Education, p. 157.

4.3.3 Correlations at Brimbank Population Health Area level

Estimated Rates of Diabetes
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high estimated rates of diabetes
Physical and social infrastructure
Cultural supermarkets – per person (.902**)
State primary schools – per person (.838**)
State primary schools – proximity to residences (.679*)
Packaged liquor licenses – proximity to residences (.678*)
Accident black spots – proximity to residences (.643*)
Flexible learning centres – per person (.642*)
Late-opening GPs – proximity to residences (.520)
Health and wellbeing indicators
Estimated rates of self-assessed poor or fair health (.960**)
Estimated rates of male smokers (.903**)
Estimated rates of psychological distress (.885**)
Estimated rates of female obesity (.881**)
Estimated rates of harmful alcohol use (.846**)
People aged under 65 living with a disability – percent (.841**)
Contextual indicators
Percentage of jobless families (.958**)
Socio-economic disadvantage (.952**)
Percentage of single-parent families (.908**)
Dwellings in mortgage stress (.872**)
Percentage born in NES country (.849**)
Dwellings with no motor vehicle (.867**)
Dwellings in rental stress (.639*)
Education and child development
Rates of early school leavers (.876**)
Children developmentally vulnerable on one or more domains (.636*)
Demographics [no significant results]

Estimated Rates of Diabetes
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high estimated rates of diabetes
Physical and social infrastructure Trees [open space] – per person (-.691*) Percentage of parkland (-.638*) Contour variation (-.634*) Late-opening GPs – per person (-.055) **Health and wellbeing indicators** [no significant results] **Contextual indicators** People engaged in voluntary work (-.680*) **Education and child development** [no significant results] **Demographics** [no significant results]

4.3.4 Summary of correlations

In the PHAs in Brimbank with higher estimated rates of **diabetes**, there are higher estimated rates of self-assessed poor or fair health, male smokers, psychological distress, female obesity and harmful alcohol use, associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

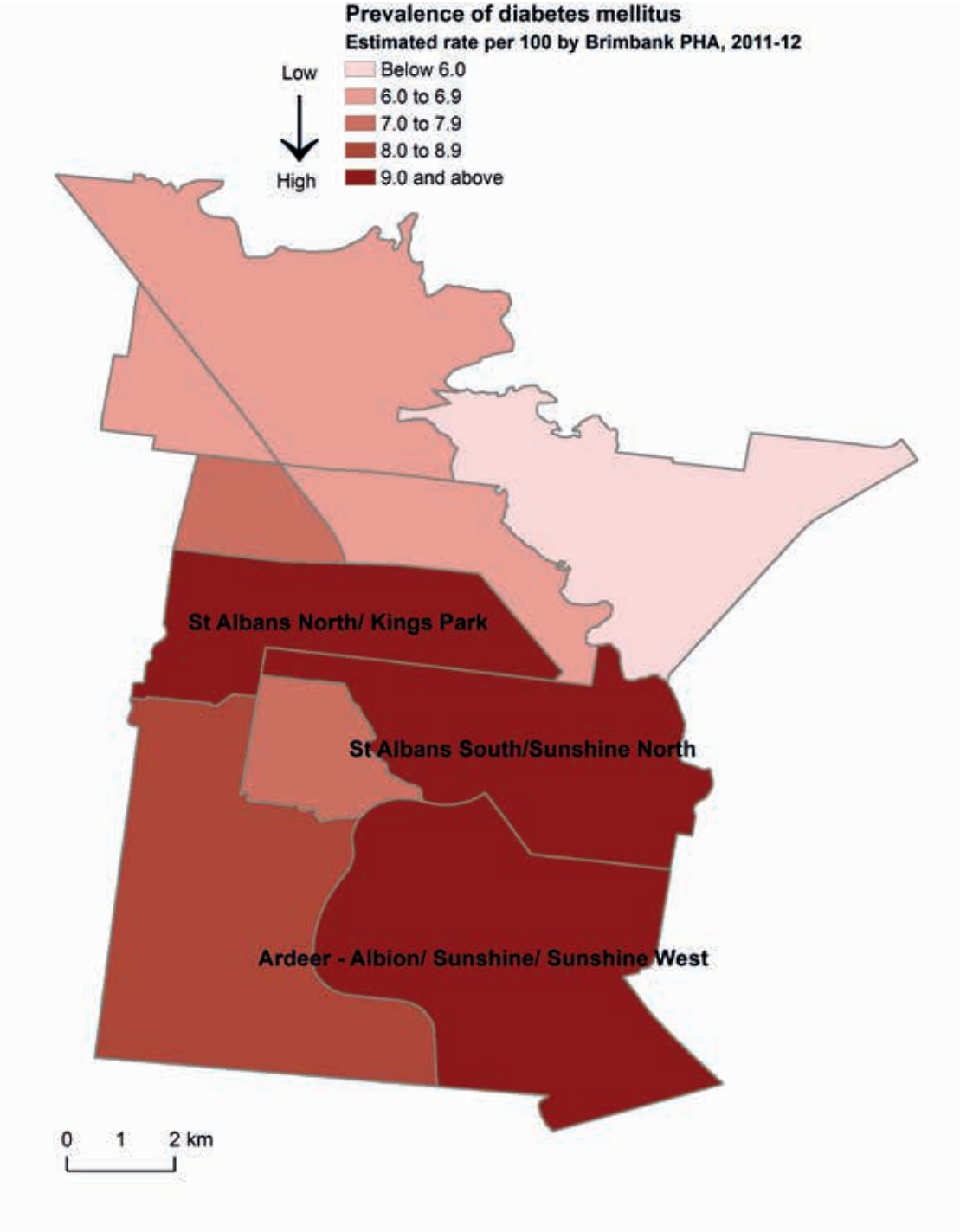
Infrastructure

- Significantly more cultural supermarkets and state primary schools per person.
- More state primary schools closer to residences.
- Greater proximity to packaged liquor licenses.
- Lower proportions of people engaged in voluntary work.
- Fewer open space trees per person.
- Fewer hills.
- Less parkland.
- And, to a lesser degree:
    - flexible learning centres per person; and
    - accident black spots in proximity to residences.

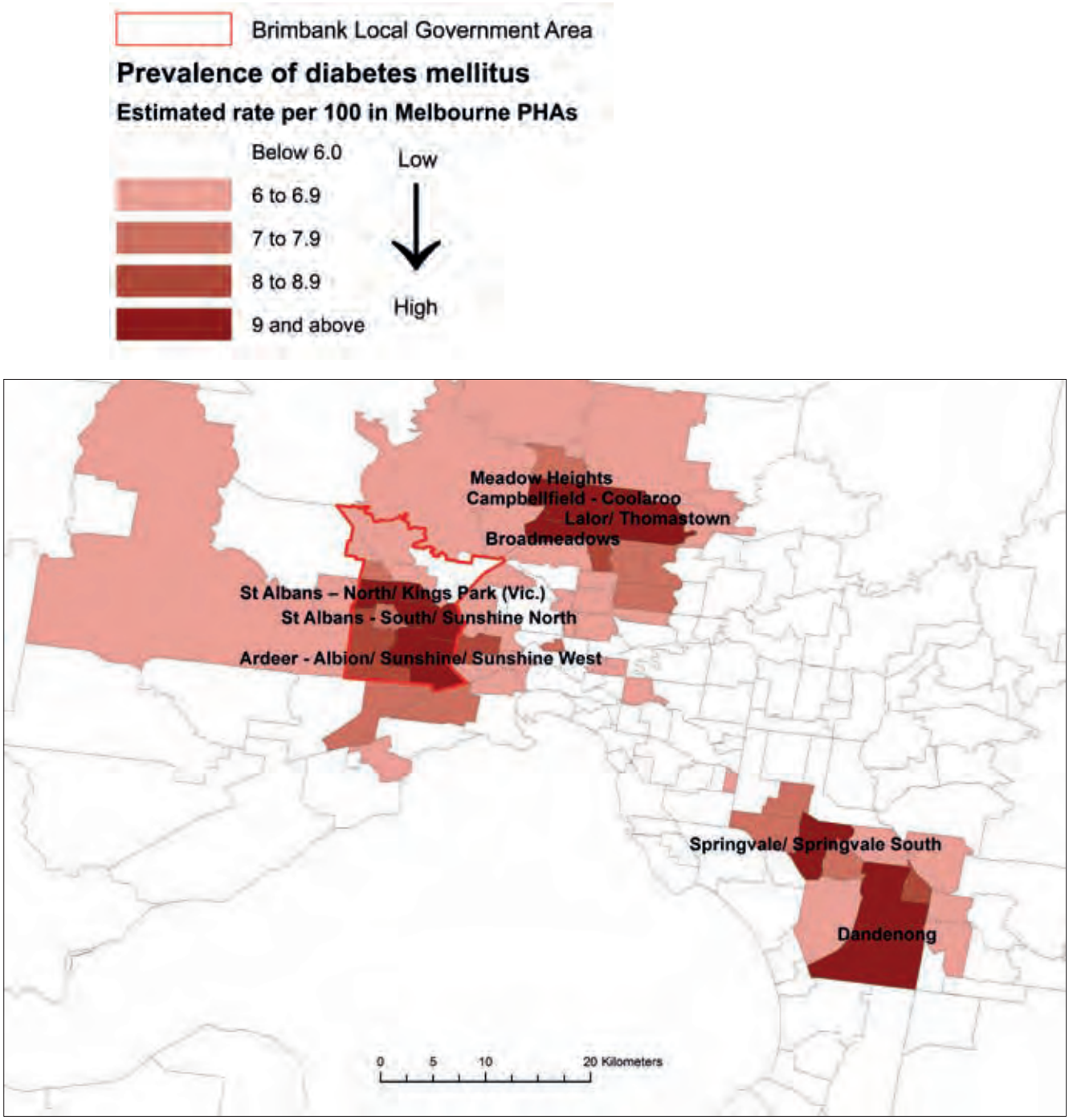
Context

- More people aged under 65 years living with a disability.
- Greater socio-economic disadvantage.
- Higher proportions of jobless families, single-parent families, dwellings in mortgage stress, people born in NES countries, and dwellings with no motor vehicle.
- Higher proportions of early school leavers and higher proportions of developmentally vulnerable children.

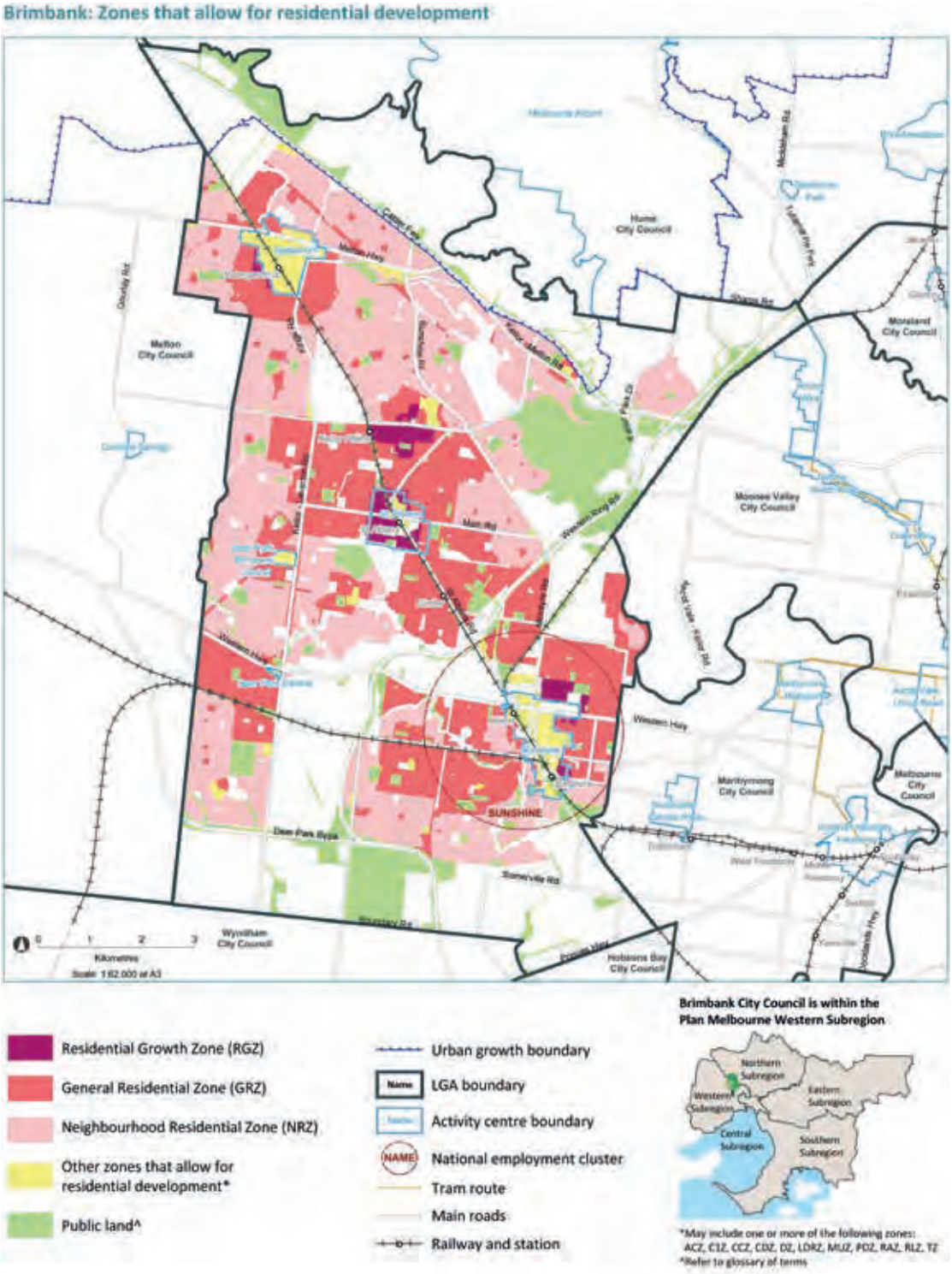
4.3.5 Maps



Map 4.3.1 Estimated rates of diabetes in Brimbank PHAs



Map 4.3.2 Estimated rates of diabetes in Melbourne PHAs



Map 4.3.3 Proximity of Transport to Residential Zones in the City of Brimbank

Source: https://www.planning.vic.gov.au

4.3.6 Discussion

Diabetes is closely related to other health indicators and to obesity in particular. The health correlations show very similar patterns to other indicators and are therefore not repeated in this discussion or those in following sections. However, the correlations of social and physical infrastructure to poor health outcomes do require further discussion.

Diabetes is a serious health condition with increasing prevalence across Australia and particularly high rates within Brimbank. Diabetes can be expected to have negative impacts on the health of individuals in Brimbank, and to increase future health service demand.

Diabetes Australia notes that Type 2 diabetes represents 85–90% of all known cases of diabetes, that its exact causes are unknown but it is "associated with modifiable lifestyle risk factors", and that it "usually develops in adults over the age of 45 years but is increasingly occurring in younger age [groups]" (Diabetes Australia, 2015).[20]

In Brimbank, high rates of avoidable hospitalisations for diabetes are recorded for both adults (over 15 years) and children (0–14 years).

Diabetes rates in Brimbank can be seen as an *outcome* of the overlapping health and wellbeing factors described in this report. Diabetes has serious implications for the future health of the community.

Similar to self-assessed poor health and obesity, which have already been addressed in detail (pages 50-65 and 66–91 respectively), the significant correlations identified in this report are between diabetes and:

1. obesogenic environments, including:
    - environmental determinants of food availability (see Maps 4.2.6 to 4.2.9, and pages 89-90);
    - environmental determinants of physical activity and obesity (see page 89);
2. uneven distribution of fresh food availability;
3. harmful use of alcohol;
4. gender and physical activity and the reducing rates with age and particularly in women;
5. proximity of open space and tree canopy; and
6. community engagement through volunteering.

A physical aspect of this community that potentially relates to diabetes has not been directly explored and requires further study.

Several long-term studies have found that exposure to traffic-related air pollution is associated with increased risk of type 2 diabetes in adults. Residential proximity to a road (in women) and exposure to particulate matter have been linked to diabetes risk, especially for those who had a healthy lifestyle, were physically active, and did not smoke – factors that should be protective (Andersen et al. 2012). While not all of the human studies of air pollution and type 2 diabetes show positive associations, many do. The differences in associations may relate to air pollution exposure levels, individual and genetic differences, population differences, length of exposure, socio-economic status, and/or stress (Rajagopalan & Brook 2012).

Given this association, and that access to such as green spaces for physical and social activity requires most residents to travel via, or to cross, major arterial roads, an area for further exploration is the extent to which diabetes in the City of Brimbank is geographically linked to patterns of air pollution.

Map 4.3.3 illustrates the proximity of residential zones to main roads and other transport modes.

Later in this report, map 4.5.6 shows the main arterial road traffic volumes related to hospitalisations for 0–14-year-olds, and demonstrates that several disadvantaged parts of Brimbank carry very high volumes of traffic.

20 www.diabetesaustralia.com.au/type-2-diabetes

4.4 Psychological distress reported as 'high' or 'very high'

4.4.1 Summary box

Patterns of psychological distress in Brimbank are unsurprising in many respects, as they overlap with other indicators such as self-assessed poor or fair health, diabetes and obesity.

Rates of psychological distress in Brimbank are high compared to the national average. Nationally, as well as in Brimbank, psychological distress rates are higher for women than for men. However, men in Brimbank report higher rates of psychological distress than men in Australia as a whole (cf. *The Brimbank Atlas*, p. 112).

The density of cultural supermarkets, and the number of packaged liquor licenses per person and state primary schools per person are strongly correlated with high psychological distress in Brimbank. There are weaker correlations with the environment and topography.

Many of the **contextual indicators** of socio-economic disadvantage relate to psychological distress (such as dwellings with no motor car, joblessness, and single-parent families), including **health indicators** related to smoking (particularly in men) and harmful alcohol use.

Some associations related to the presence and proximity of features that are too ubiquitous to return significant correlations, such as poker machine licenses (see map 4.4.3), are nevertheless important and need to be understood.

4.4.2 Psychological distress

The Brimbank Atlas of Health and Education presents estimates[21] of psychological distress rates in Brimbank PHAs. It notes that rates of people aged 18 years and older in Brimbank reporting high or very high psychological distress on the Kessler Psychological Distress Scale are above the national average, and that these rates vary considerably between PHAs in Brimbank.

As in national data, the rates are different for men and women.

The *Atlas* reports:

- The overall rate of **men in Brimbank** reporting high or very high psychological distress is **37% above the Australian rate**.
- In the Sunshine SLA (the southern half of Brimbank), rates of high or very high psychological distress for men are **50% above the national average**.
- The overall rate of **women in Brimbank** reporting high or very high psychological distress is higher than for men, and **16% above the Australian rate**.

For both men and women, there is significant geographical variation in rates of high or very high psychological distress across Brimbank PHAs (see Map 4.4.2).

- In the St Albans – South/Sunshine North PHA, rates of psychological distress are 17% **above** the Brimbank average for both men and women.
- In the Keilor PHA, rates of psychological distress are:
  - 29% **below** the Brimbank average for men, and
  - 26% **below** the Brimbank average for women.

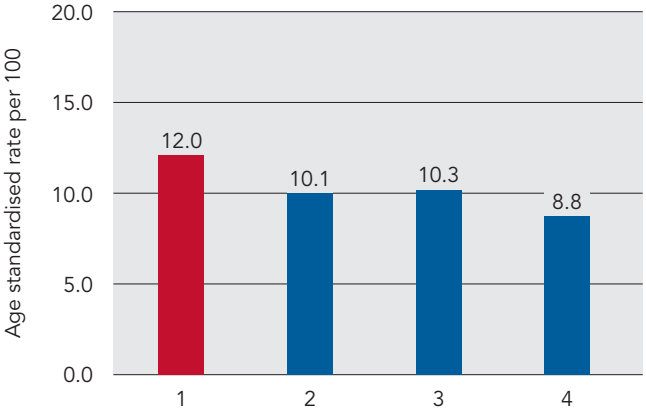


Figure 4.4.1 Estimated number of males aged 18 years and over with high or very high psychological distress, 2011–2012

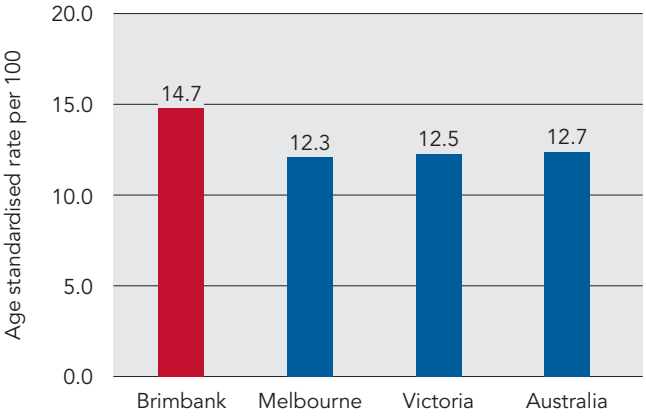


Figure 4.4.2 Estimated number of females aged 18 years and over with high or very high psychological distress, 2011–12

Maps 4.4.1-4.4.5 show psychological distress data for Brimbank PHAs and Melbourne PHAs, and overlays of key indicator data.

21 Rates were estimated by the Australian Bureau of Statistics, from the 2010 General Social Survey and from the Australian Health Survey, 2011–13. Refer to the data descriptions in Appendix C of the Brimbank Atlas of Health and Education, p. 157.

4.4.3 Correlations at Brimbank Population Health Area level

Estimated rates of 'high' or 'very high' psychological distress (both genders)
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high estimated rates of psychological distress
Physical and social infrastructure Cultural supermarkets – per person (.883**) State primary schools – per person (.839**) Packaged liquor licenses – per person (.780**) Packaged liquor licenses – proximity to residences (.710*) State primary schools – proximity to residences (.681*) Late-opening GPs – proximity to residences (.448)
Health and wellbeing indicators Estimated rates of male smokers (.922**) Estimated rates of harmful alcohol use (.891**) Estimated rates of diabetes (.885**) Estimated rates of self-assessed poor or fair health (.841**) Estimated rates of female obesity (.787**) People aged under 65 living with a disability (.675*)
Contextual indicators Dwellings with no motor vehicle (.911**) Socio-economic disadvantage (.908**) Percentage of jobless families (.881**) Percentage of single-parent families (.837**) Dwellings in mortgage stress (.787**) Percentage born in NES country (.775**) Dwellings in rental stress (.679*)
Education and child development Rates of early school leavers (.834**) Children developmentally vulnerable on one or more domains (.648*)
Demographics [no significant results]

Estimated rates of 'high' or 'very high' psychological distress (both genders)
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high estimated rates of psychological distress
Physical and social infrastructure Walking school bus stops – per person (-.769**) Contour variation (-.714*) Percentage of parkland (-.703*) Trees [open space] – per person (-.663*) Women's gyms – proximity to residences (-.645*) Late-opening GPs – per person (-0.27) **Health and wellbeing indicators** [no significant results] **Contextual indicators** Percentage learning or earning aged 15 to 19 years (-.665*) **Education and child development** [no significant results] **Demographics** Proportion of population aged 45 to 64 years (-.643*)

4.4.4 Summary of the correlations

In PHAs in Brimbank with higher estimated rates of **high or very high psychological distress**, there are higher estimated rates of male smokers, female obesity and diabetes, and harmful alcohol use, associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

Infrastructure

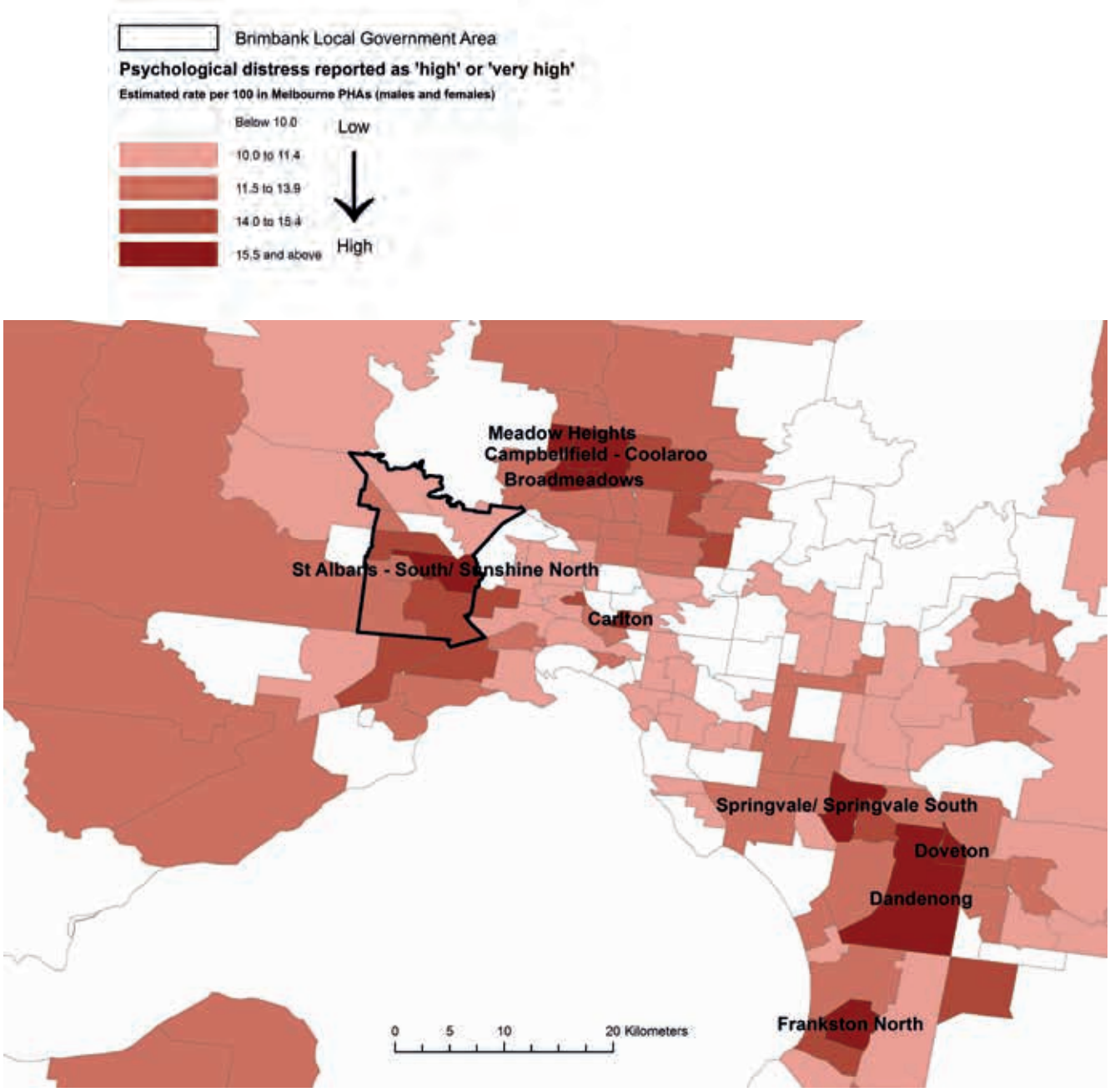
- Significantly more cultural supermarkets, state primary schools, and packaged liquor licenses per person.
- Significantly greater proximity to state primary schools and to packaged liquor licenses.
- Fewer walking school bus stops and trees per person.
- Fewer hills.
- Less parkland.
- Greater distances from women's gyms.

Context

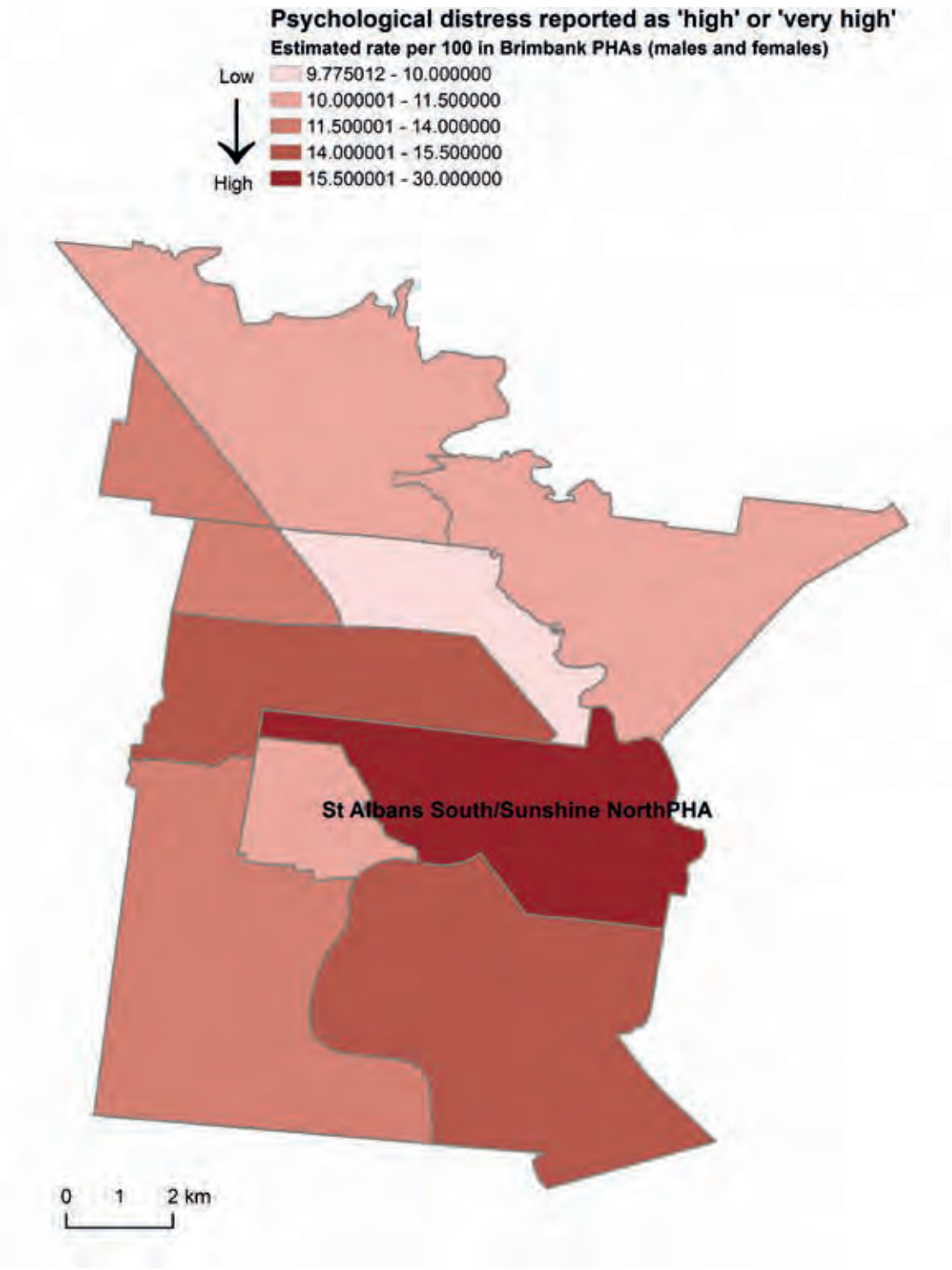
- More people aged under 65 years living with a disability.
- Greater socio-economic disadvantage.
- Higher proportions of dwellings with no motor vehicle, jobless families, single-parent families, dwellings in mortgage stress, and people born in NES countries.
- Higher proportions of early school leavers and higher proportions of developmentally vulnerable children.
- Lower proportions of people aged 15 to 19 years who are learning or earning.
- A lower proportion of the population aged 45 to 64 years.

NB Whilst there is no correlation of poker machines with estimated rates of psychological distress in Brimbank, Map 4.4.3 shows their distribution. Consideration of this feature is included in the discussion.

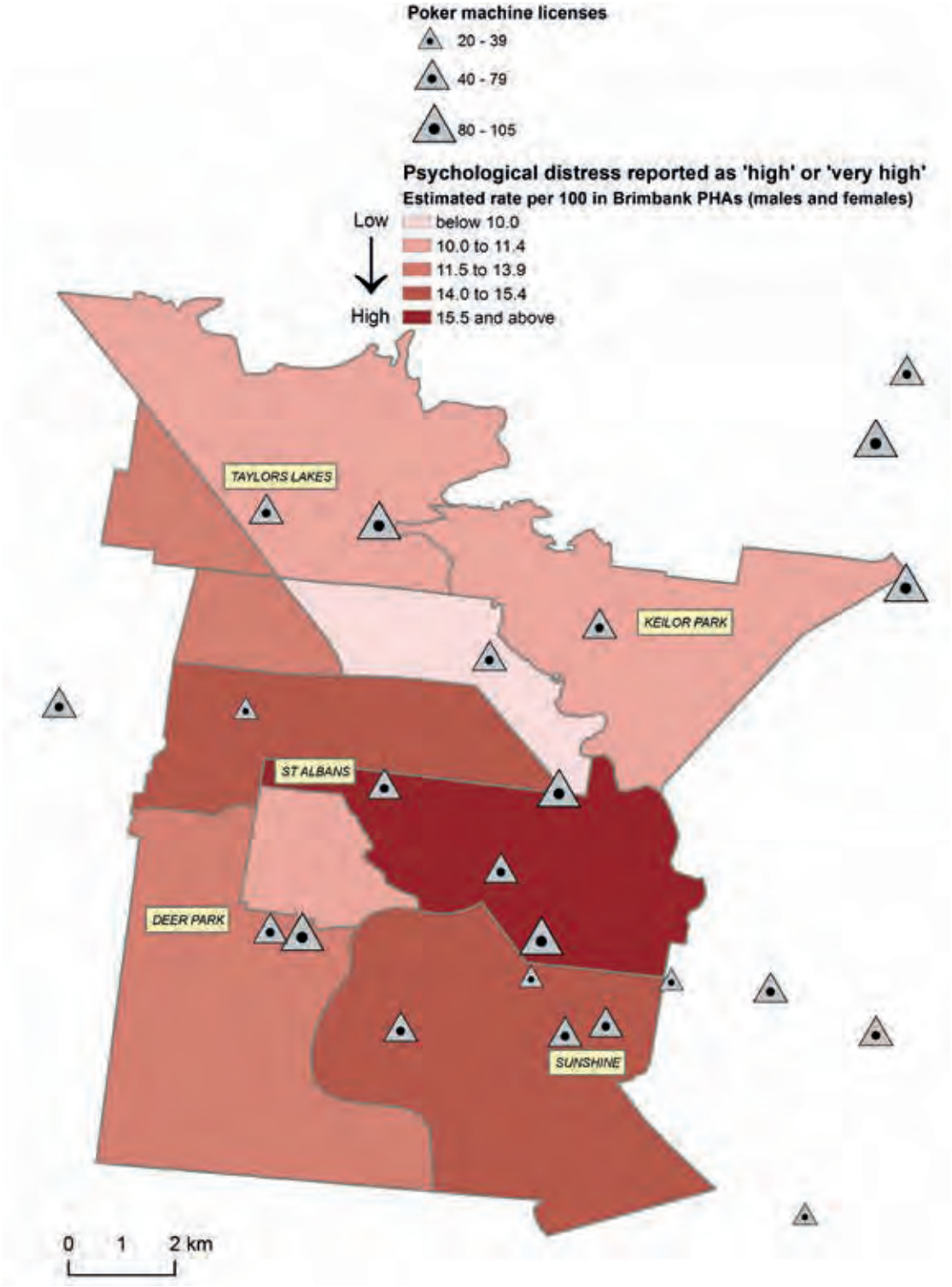
4.4.5 Maps



Map 4.4.1 Estimated rates of psychological distress in Melbourne PHAs

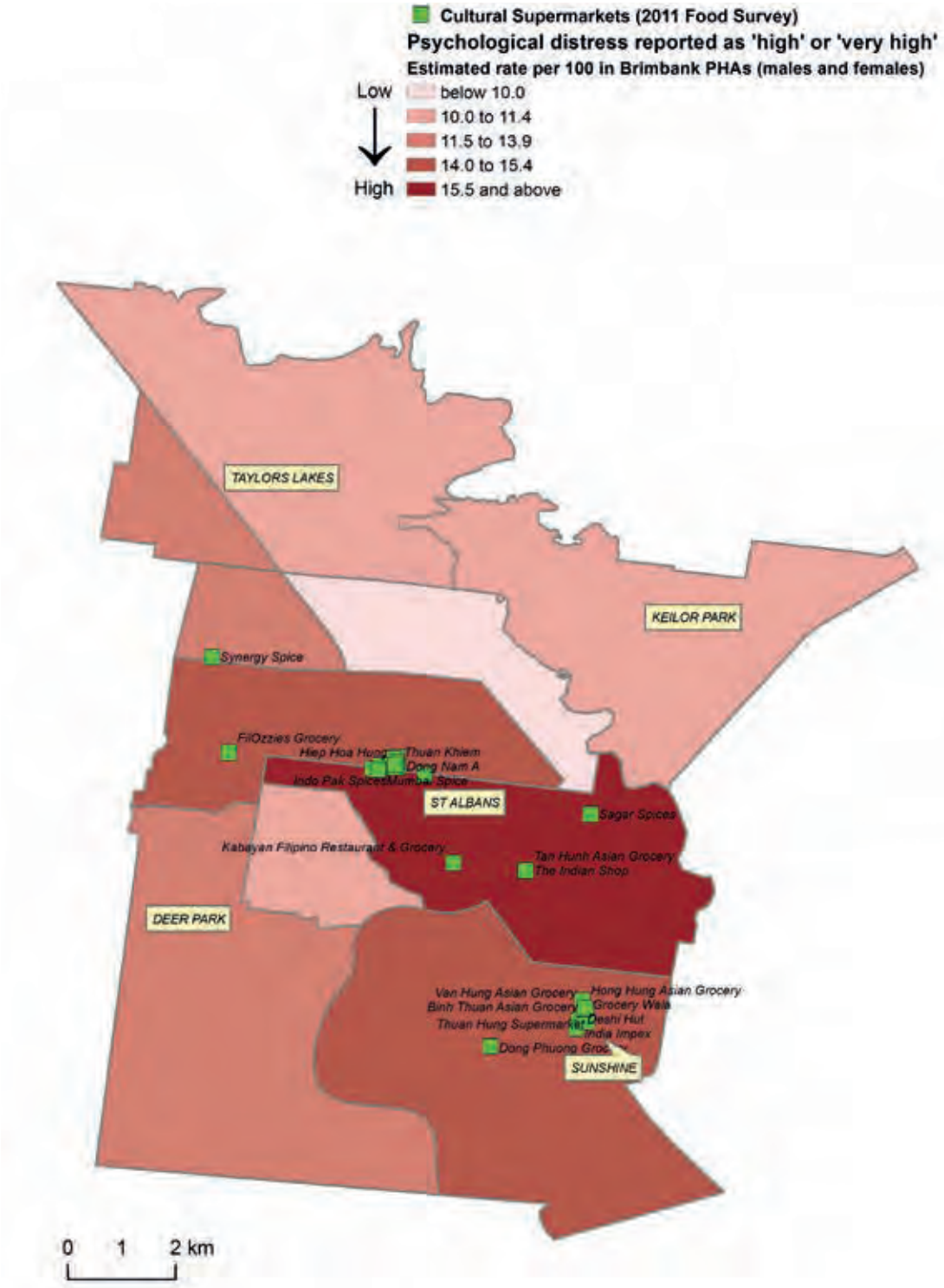


Map 4.4.2 Estimated rates of psychological distress in Brimbank PHAs



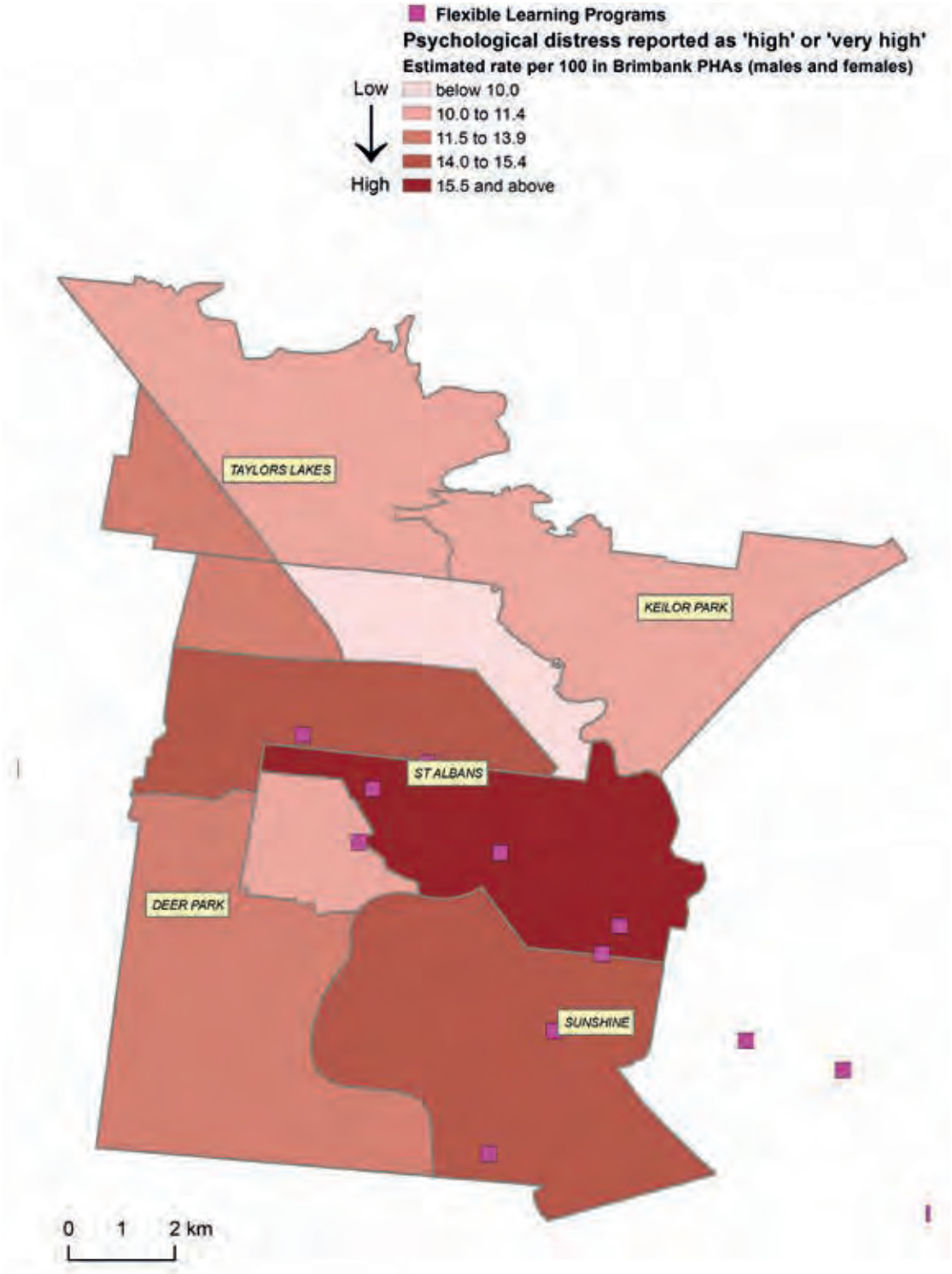
Map 4.4.3 Estimated rates of psychological distress in Brimbank Population Health Areas

Overlay for poker machines



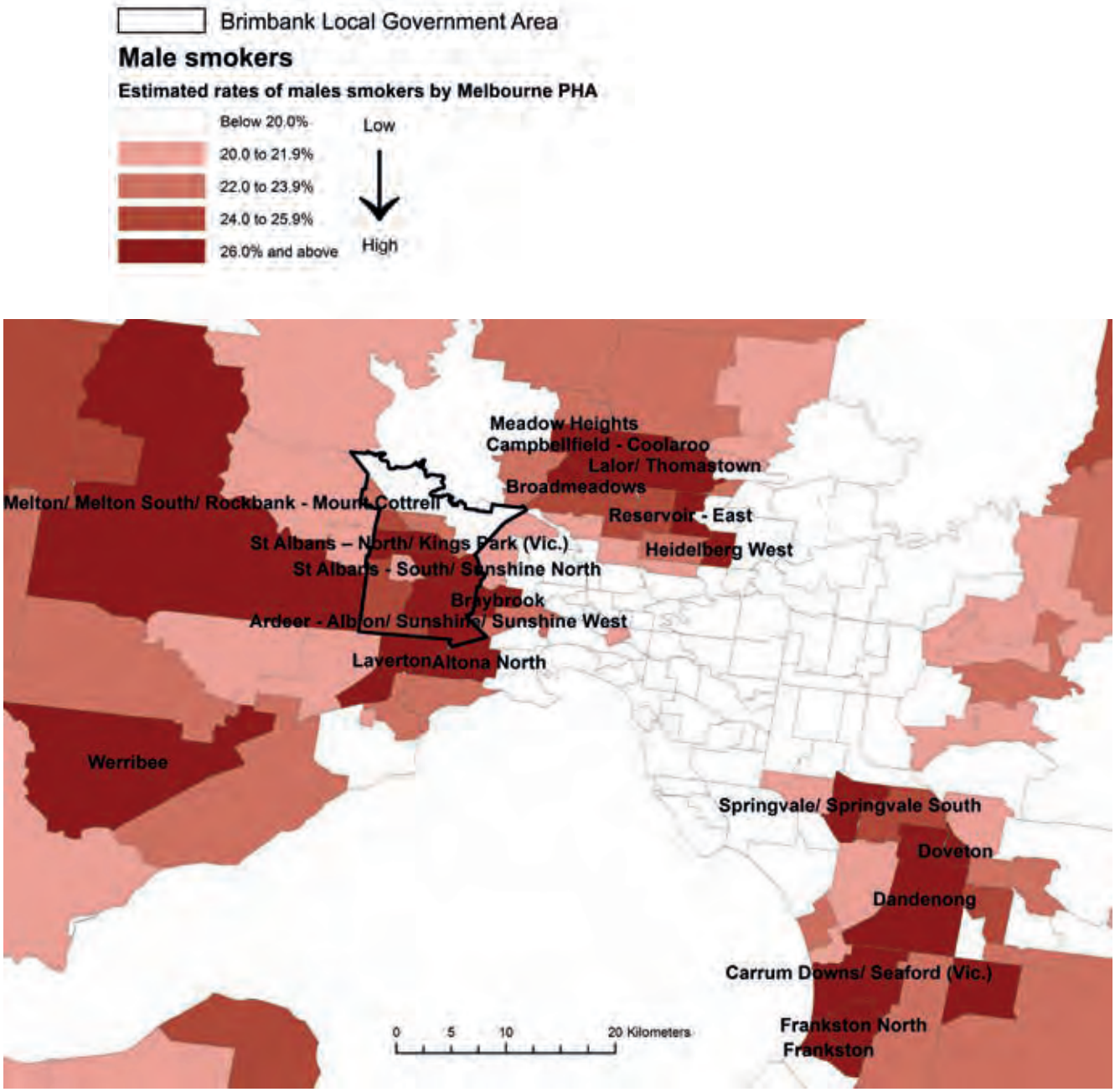
Map 4.4.4 Estimated rates of psychological distress in Brimbank Population Health Areas

Overlay for cultural supermarkets (2011 food survey)

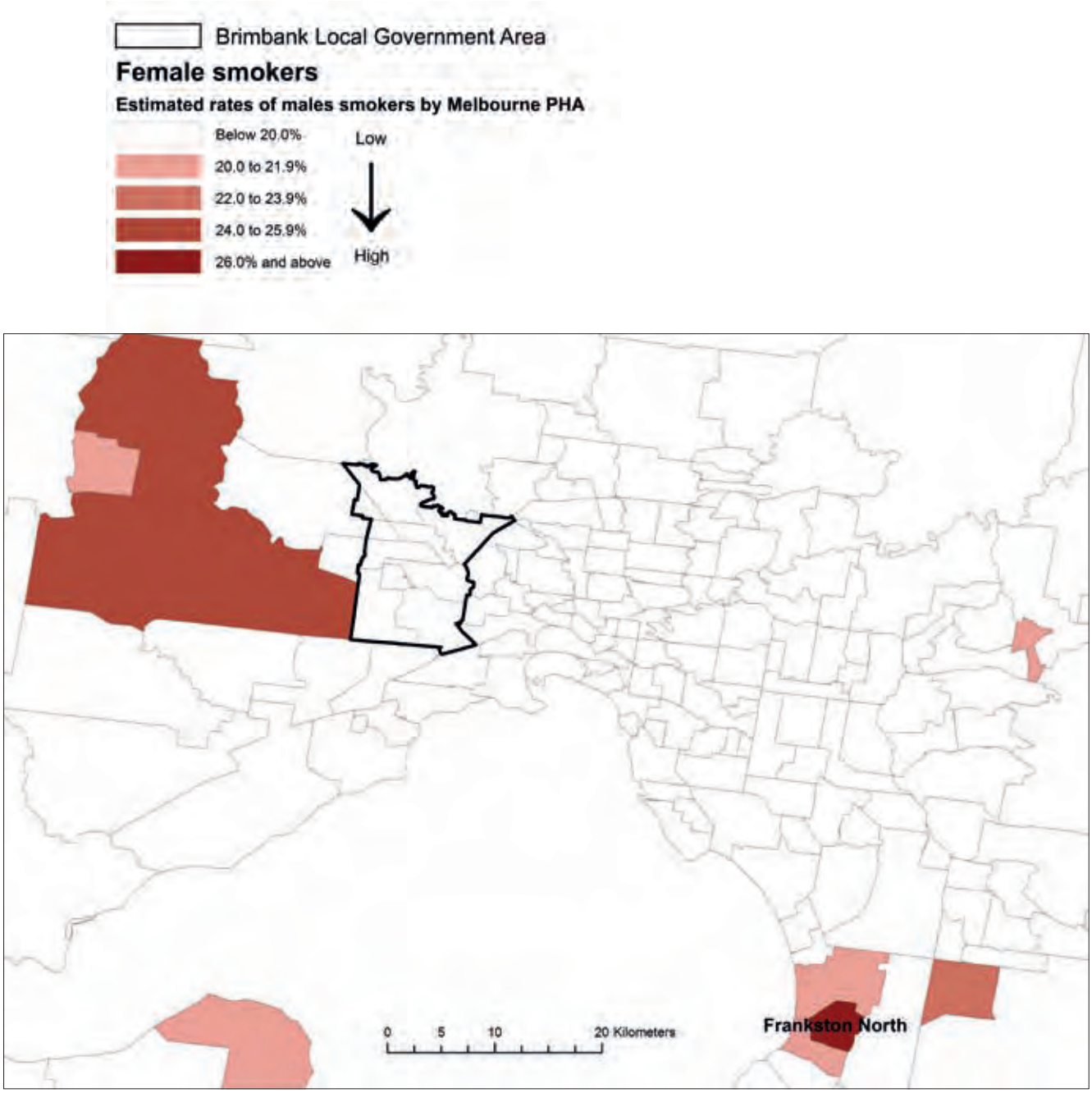


Map 4.4.5 Estimated rates of psychological distress in Brimbank Population Health Areas

Overlay for Flexible Learning Programs

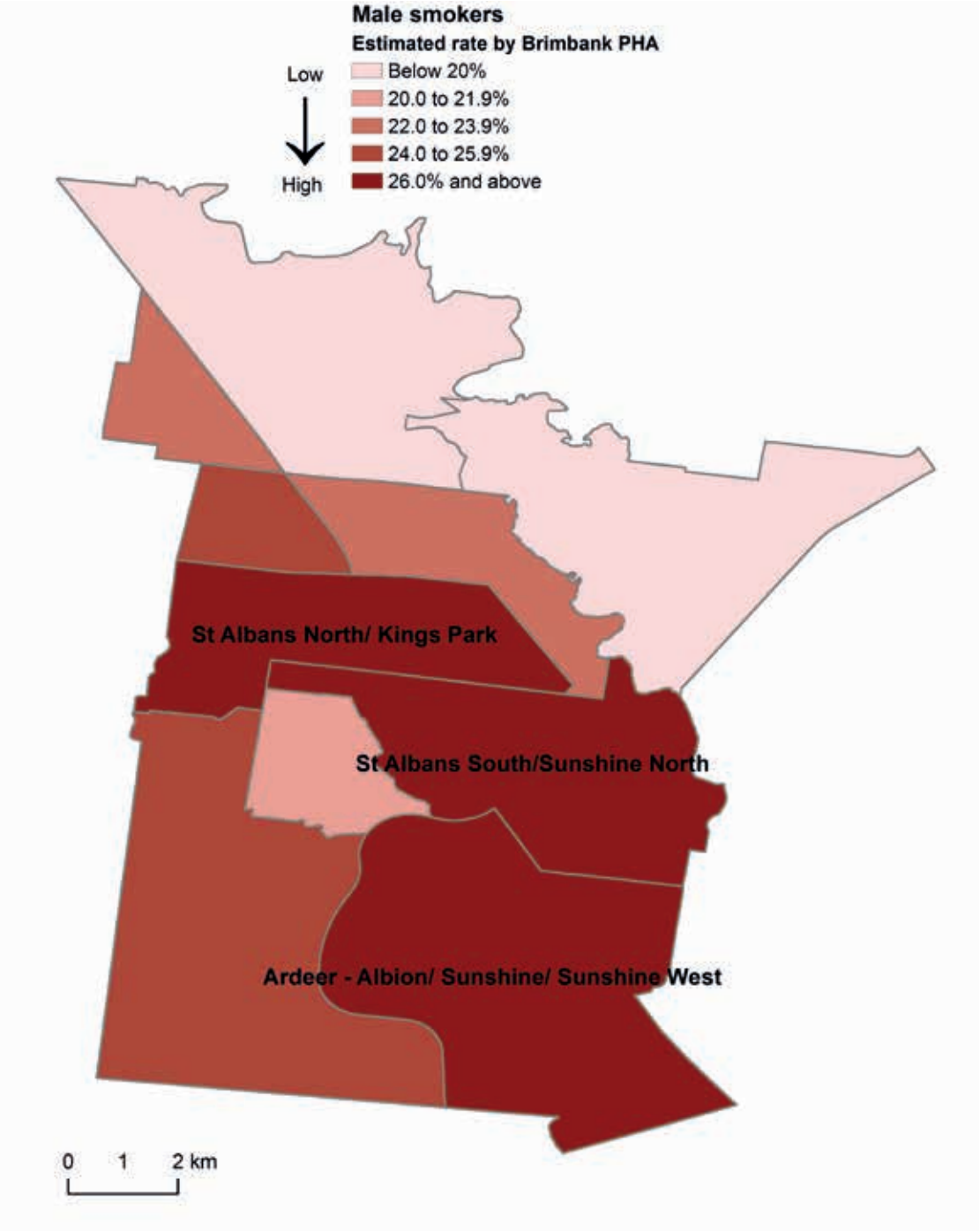


Map 4.4.6 Estimated % of males smoking in 2011–12 by Melbourne PHA



Map 4.4.7 Estimated % of females smoking in 2011–12 by Melbourne PHA

Note that this uses the same colour ramp as male smokers.



Map 4.4.8 Estimated % of males smoking in 2011–12 by Brimbank PHA

The correlations of male smoking to health and wellbeing indicators (harmful alcohol use 0.970; self-assessed poor or fair health 0.946; psychological distress 0.922 and diabetes 0.903) and to contextual factors (such as socio-economic disadvantage 0.972; percentage of jobless families 0.959; percentage of single-parent families 0.948; dwellings with no motor vehicle 0.890; dwellings in mortgage stress 0.836; and percentage born in NES country 0.829) are significant.

4.4.6 Discussion

It is apparent by now that maps of self-assessed fair or poor health, obesity, diabetes and psychological distress look similar, if not identical, and they all correlate with the IRSD.

These correlated conditions have a tendency to be "wicked problems" (Kreuter et al. 2004), that is, hard to untangle quickly, with no single solution apparent.

For example, psychological distress rates vary by gender, by location, and to a lesser extent by age. The patterns also show some variation from other indicators in this report. This is likely to be influenced by the fact that younger people rate higher in psychological distress (whereas diabetes risk increases with age). The older populations in Keilor may contribute to lower rates of psychological distress: note the inverse correlation of the population aged 45–64 years to high psychological distress in the negative correlation table on page 104.

At Brimbank PHA level there are no significant correlations between psychological distress and poker machines. However, poker machine venues within Brimbank are – like take-away stores – ubiquitous rather than uneven. This is emphasised in Map 4.4.3. In 2014–15, Brimbank LGA had the second-highest expenditure per adult on poker machines (an average of $910.82 per adult, and a total of $141,609,226.77 in one year) of any municipality in Melbourne.[22]

This reflects a pattern of socio-economic disparity in poker machine distribution identified many years ago (Marshall & Baker 2001). Given the range of contextual indicators that are prevalent in Brimbank, particularly in areas of elevated psychological distress – jobless families, mortgage stress, rental stress, dwellings without a motor vehicle, recent arrivals from NES countries – poker machine venues might be seen as relatively safe and comfortable spaces, an "accessible retreat from life issues" (Thomas et al. 2011).

Flexible Learning Programs[23] (shown in Map 4.4.5) are most prevalent in areas of Brimbank with high estimated rates of psychological distress. This could mean that these programs are appropriately targeted to co-related factors, and that some services move to the location of the need.

The correlation between smoking and high rates of psychological distress is very strong (0.922). Tobacco use varies by gender, location, and socio-economic status. The pattern of **male smoking** resembles that of **female obesity** in Brimbank; prevalence is highest in areas with the most socio-economic disadvantage, and 26% above the national average.

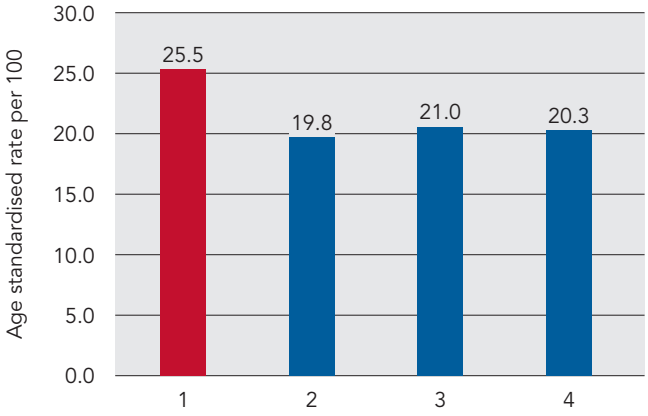


Figure 4.5.1 Estimated male population 18 and over who were current smokers, 2011-12

There is geographical variation in smoking rates between PHAs in Brimbank. The highest estimated rates of male smokers were in the PHAs of St Albans – South / Sunshine North (28.8 male smokers per 100 population), St Albans – North / Kings Park (28.4), Ardeer – Albion / Sunshine West (27.8), and Deer Park – Derrimut (25.9).

Women smoke less than men, both in Australia and in Brimbank. Smoking rates for women in Brimbank are lower than the national average at 14.5% compared to 15.7%. Rates of smoking during pregnancy have dropped since 2011.

22 Poker machine expenditure by LGA (including average per adult) is available from: www.vcglr.vic.gov.au/home/resources/data+and+research/data/. The highest Victorian poker machine expenditures per person in 2014–2015 were in the LGAs of Greater Dandenong, Brimbank, and Maribyrnong. These LGAs all have high rates of socio-economic disadvantage.

23 Learning Choices are programs and initiatives, both outside school and in schools, designed to meet the diversity of needs for young people to be actively and positively engaged with their learning, achieving better life and learning outcomes and building pathways to further learning beyond school. http://dusseldorp.org.au/priorities/alternative-learning/program-database/

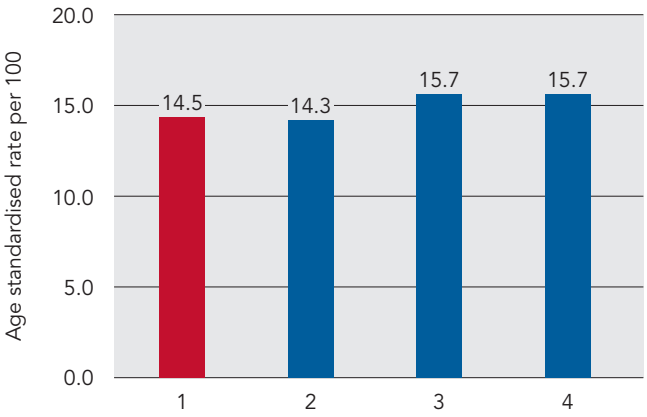


Figure 4.5.2 Estimated female population 18 and over who were current smokers, 2011–12

Both these patterns are consistent with wider literature: socio-economically disadvantaged populations are more likely to smoke (Laaksonen et al. 2005), and males are more likely to smoke than females, but the gap between males and females varies by region and culture (Amos et al. 2012, Glover et al. 2004). Hence, cultural norms may impact on female smoking rates in Brimbank.

Melbourne male smoking patterns are also consistent with US research which concluded that "men in poor neighborhoods were more likely to smoke than those in less disadvantaged places, but neighborhood context had no significant effect on women's likelihood of smoking" (Ross, 2000).

Overall, the patterns of psychological distress emphasise the overlap between socio-economic context, physical health and mental health. However, levels of psychological distress vary for both men and women by SLA and PHA, and migration and culture are powerful influences.

The level of overlap between psychological distress and other health and wellbeing indicators in this report reiterates that policy separation of mental health, physical health, social health and environment is unlikely to be effective: they come together in a 'wicked' package. Nevertheless, psychological distress shows distinct patterns, indicating that it merits specific consideration.

4.5 Hospitalisations for ambulatory care-sensitive conditions

4.5.1 Summary box

Ambulatory care-sensitive conditions (ACSCs) are those for which hospitalisation is thought to be avoidable with the application of public health interventions and early disease management, usually delivered in ambulatory settings such as primary care and particularly general medical practitioner services. High rates of hospital admissions for ACSCs may be indirect evidence of problems with patient access to primary healthcare, inadequate skills and resources, or disconnection from specialist services.

Annual data for ACSCs are presented by financial year (1 July to 30 June), consistent with the release of hospitalisation data in Victoria.[24]

Hospitalisation rates for ACSCs are high in Brimbank for both children and adults, but show unusual patterns. These patterns are not repeated elsewhere in this report.

Socio-economic disadvantage is not correlated with ACSC hospitalisations in Brimbank:

- the highest ACSC hospitalisation rates for children are in the least socio-economically disadvantaged parts of Brimbank;
- the highest rates for children are in areas of Brimbank (eg. Keilor) with lower proportions of children and higher median age, and relate particularly to dental conditions and asthma;
- the highest rates for adults are in the northwest of Brimbank, around Sydenham. This is an area of medium socio-economic disadvantage relative to all Brimbank;
- there are many medical practices in Brimbank, particularly in St Albans. GP utilisation rates in Brimbank are also high. The rate of provision of Enhanced Primary Care items[25] (which has been used as a proxy for service use) in Brimbank is low in comparison to overall GP services; and
- the lowest childhood ACSC hospitalisation rates in Brimbank are in areas with a higher proportion of late-opening GPs.

There are weaker relationships between ACSCs and Brimbank's physical and social infrastructure – such as packaged liquor licenses per person, licensed clubs per person, industrial zones, primary schools per person, proximity of accident black spots to residences, and state primary schools per person – than for other risk factors.

This pattern of hospitalisations in relatively advantaged areas is an anomaly. It will be the focus of further enquiry to identify the underlying problems, and whether the patterns apply in similarly advantaged areas of Greater Melbourne.

24 Victorian Health Information Surveillance System, last updated 06 August, 2016

25 Enhanced Primary Care (EPC) care planning items were removed from the Medicare Benefits Schedule (MBS) in 2005 and replaced by the Chronic Disease Management (CDM) items (721–732). The Chronic Disease Management (formerly Enhanced Primary Care or EPC) GP services on the MBS enable GPs to plan and coordinate the health care of patients with chronic or terminal medical conditions, including patients with these conditions who require multidisciplinary, team-based care from a GP and at least two other health or care providers (allied health and nursing) http://www.health.gov.au/EPC

4.5.2 Ambulatory care-sensitive conditions

The *Brimbank Atlas of Health and Education* presents data on hospitalisations for ACSCs for children aged 0 to 14 and for people aged 15 years and over. ACSC hospitalisation rates for both age groups are high in Brimbank compared to Victoria and Melbourne, but have an unusual pattern in that hospitalisation rates differ for children and adults.

For children aged 0 to 14, rates of ACSC hospitalisation in Brimbank are 19% higher than the Victorian average (24.6 admissions per 1,000 population in Brimbank, 20.3 in Victoria), and 30% above the Melbourne average. Much of this overrepresentation in childhood ACSC hospitalisations derives from very high rates in particular parts of Brimbank (see Map 4.5.1).

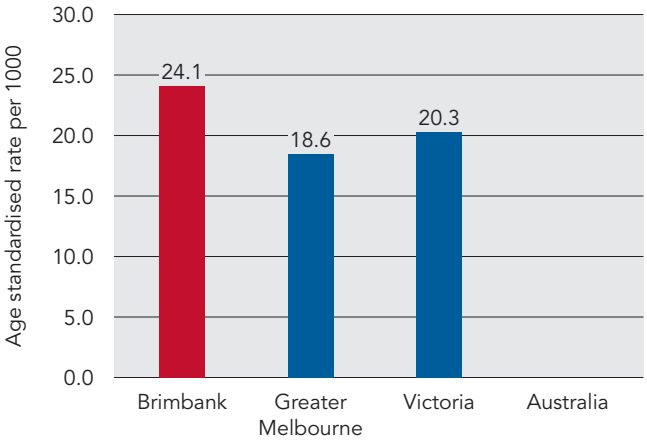


Figure 4.5.1 Hospitalisations for ACSCs, aged 0 to 14 years, 2011–12

In the Keilor SLA (the northern half of Brimbank), the rate of ACSC hospitalisations for children is **40% above** the Victorian average, and the second-highest rate of all SLAs in Melbourne.

Within Brimbank the highest rates are found in the Keilor PHA (33.1 admissions per 1,000 population) and the Keilor Downs PHA (32.5 admissions per 1,000 population). These PHAs have low socio-economic disadvantage relative to the rest of Brimbank (see Map 2.3).

For adults in Brimbank, the rates for ACSC hospitalisation rates are different than for children, and higher in the north of the municipality. In the Keilor SLA the hospitalisation rate for ACSCs for adults is 36% above the Victorian rate, and the sixth highest for SLAs in Melbourne. The rate in the Sunshine SLA (the southern half of Brimbank) is closer to the Melbourne and Victorian averages.

At PHA level, the highest rates of adult ACSC hospitalisations are in the north-west of Brimbank: Sydenham, Delahey, and Taylors Lakes (see Map 4.5.2).

Across Melbourne SLAs, ACSC hospitalisation rates for adults are strongly correlated with rates of socio-economic disadvantage and component indicators. However, high rates of ACSC hospitalisation for children occur in a mix of relatively advantaged and relatively disadvantaged areas across Melbourne. This pattern of weak connection to socio-economic disadvantage, and different distribution patterns for adults and children, is unusual when compared to other health and wellbeing indicators in Brimbank (see Maps 4.5.3–4.5.7).

Maps 4.5.1–4.5.9 show hospitalisation data for ACSCs – separated into 0–14 years and 15 years and above – for Brimbank PHAs and Melbourne PHAs, and overlays of key indicator data.

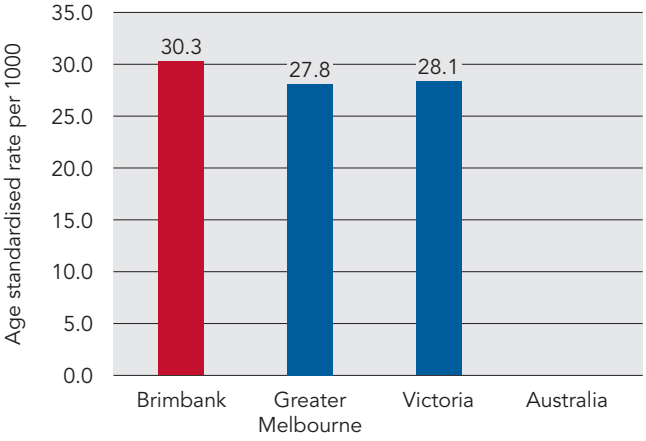


Figure 4.5.2 Hospitalisations for ACSCs, aged 15 years and over, 2011–12

4.5.3 Correlations at Brimbank Population Health Area level

Hospitalisation Rates for ACSCs for ages 0 to 14
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high rates of hospitalisations for ACSCs for children
Physical and social infrastructure Pets – per person (.850**) Contour variation (.779**) Bus stops – proximity to residences (.747*) Dog off leash areas – per person (.685*) Conservation zones – total sqm per person (.632*) **Health and wellbeing indicators** [no significant results] **Contextual indicators** People engaged in voluntary work – percentage (.632*) **Education and child development** [no significant results] **Demographics** Proportion of population aged 45 to 64 years (.841**)

Hospitalisation Rates for ACSCs for ages 0 to 14
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high rates of hospitalisations for ACSCs for children
Physical and social infrastructure Packaged liquor licenses – proximity to residences (-.655*) Late-opening GPs – per person (-.487) Late-opening GPs – proximity to residences (-.530) **Health and wellbeing indicators** [no significant results] **Contextual indicators** [no significant results] **Education and child development** [no significant results] **Demographics** Proportion of population aged 25 to 44 years (-.916**) Proportion of population aged under 5 (-.874**) Proportion of population aged 0 to 14 years (-.863**)

Hospitalisation Rates for ACSCs for ages 15 and over
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high rates of hospitalisations for ACSCs for adults
Physical and social infrastructure [no significant results] **Health and wellbeing indicators** [no significant results] **Contextual indicators** [no significant results] **Education and child development** [no significant results] **Demographics** Proportion of population aged 15 to 24 years (.682*)

Hospitalisation Rates for Ambulatory Care-Sensitive Conditions (ACSCs) for ages 15 and over
Inverse correlations at Brimbank PHA level These attributes are LESS PREVALENT in Brimbank PHAs with high rates of hospitalisations for ACSCs for adults
Physical and social infrastructure Packaged liquor licenses – per person (-.738*) Licensed clubs – per person (-.701*) Industrial zone – percentage area (-.701*) Primary schools – per person (-.696*) Accident black spots – proximity to residences (-.662*) Residential density (ratio of population to addresses) (-.643*) State primary schools – per person (-.634*) Late-opening GPs – per person (-.157) Late-opening GPs – proximity to residences (-.246) **Health and wellbeing indicators** Estimated rates of circulatory disease (-.635*) **Contextual indicators** Dwellings with no motor vehicle (-.715*) **Education and child development** [no significant results] **Demographics** [no significant results]

4.5.4 Summary of the correlations

In the PHAs in Brimbank with higher estimated rates of hospitalisation for ACSCs for children, there are no significant associations with any other health and wellbeing indicators. These rates are associated with the following physical and social infrastructure (assets or deficits) and contextual indicators.

Infrastructure

- Fewer packaged liquor licenses, licensed clubs, and state primary schools per person.
- Less industrial land.
- Greater distances from accident black spots.
- Lower residential density.

Context

- Higher proportions of the population aged 45 to 64 years.
- Higher proportions of people engaged in voluntary work.
- More pets per person.
- More hills, conservations zones and dogs off leash areas per person.
- Greater proximity to bus stops.
- Lower proportions of the population aged 0 to 14 years (ie. fewer children).
- Lower proportions of the population aged 25 to 44 years.
- Greater distances from packaged liquor licenses.

The PHAs in Brimbank with **higher rates of hospitalisation for ACSCs for people aged 15 years and over** also had:

Infrastructure

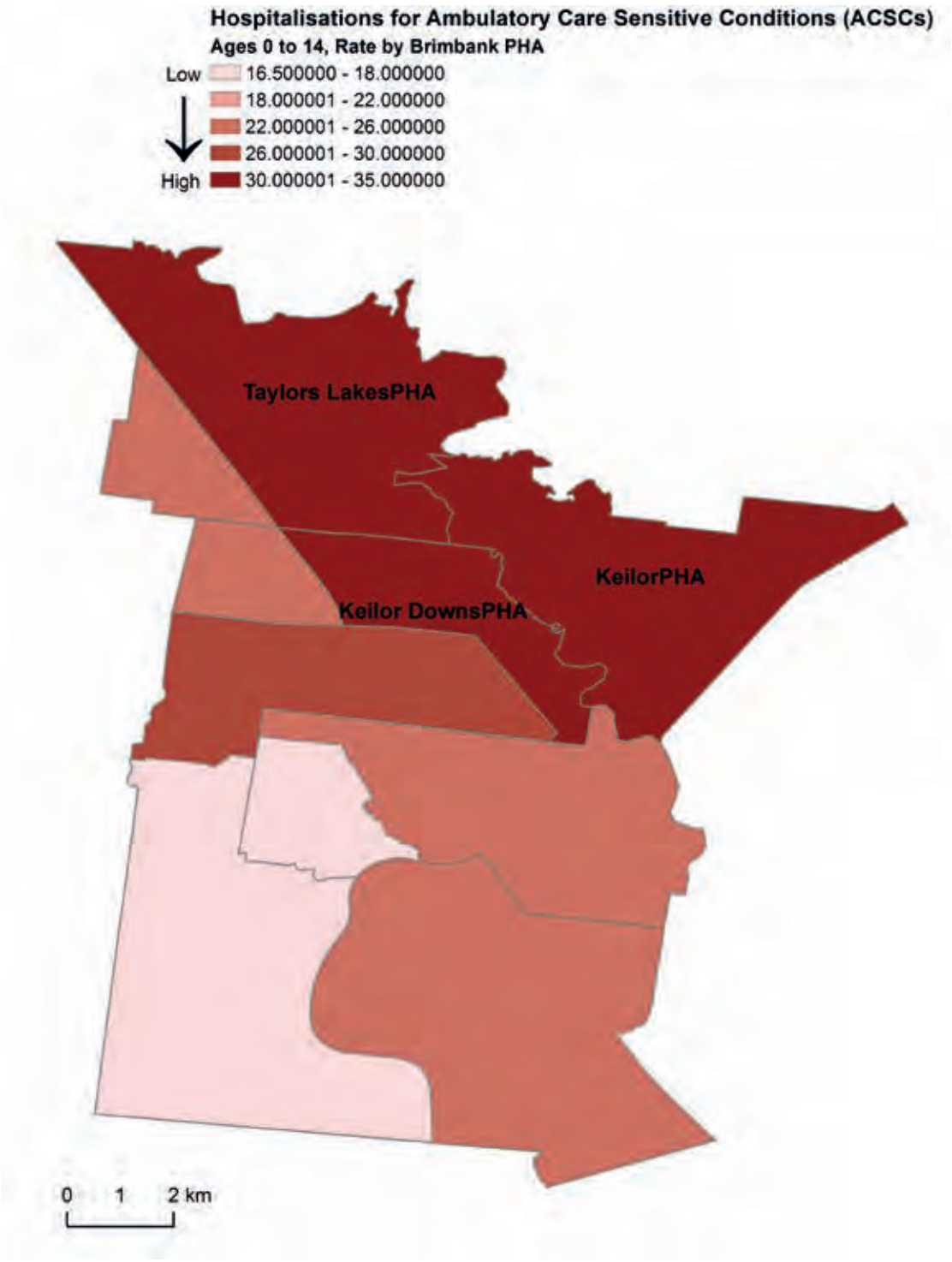
- Fewer packaged liquor licenses, licensed clubs, and state primary schools per person.
- Less industrial land.
- Greater distances from accident black spots.

Context

- Higher proportions of the population aged 15 to 24 years.
- Lower proportions of dwellings with no motor vehicle.
- Lower residential density.

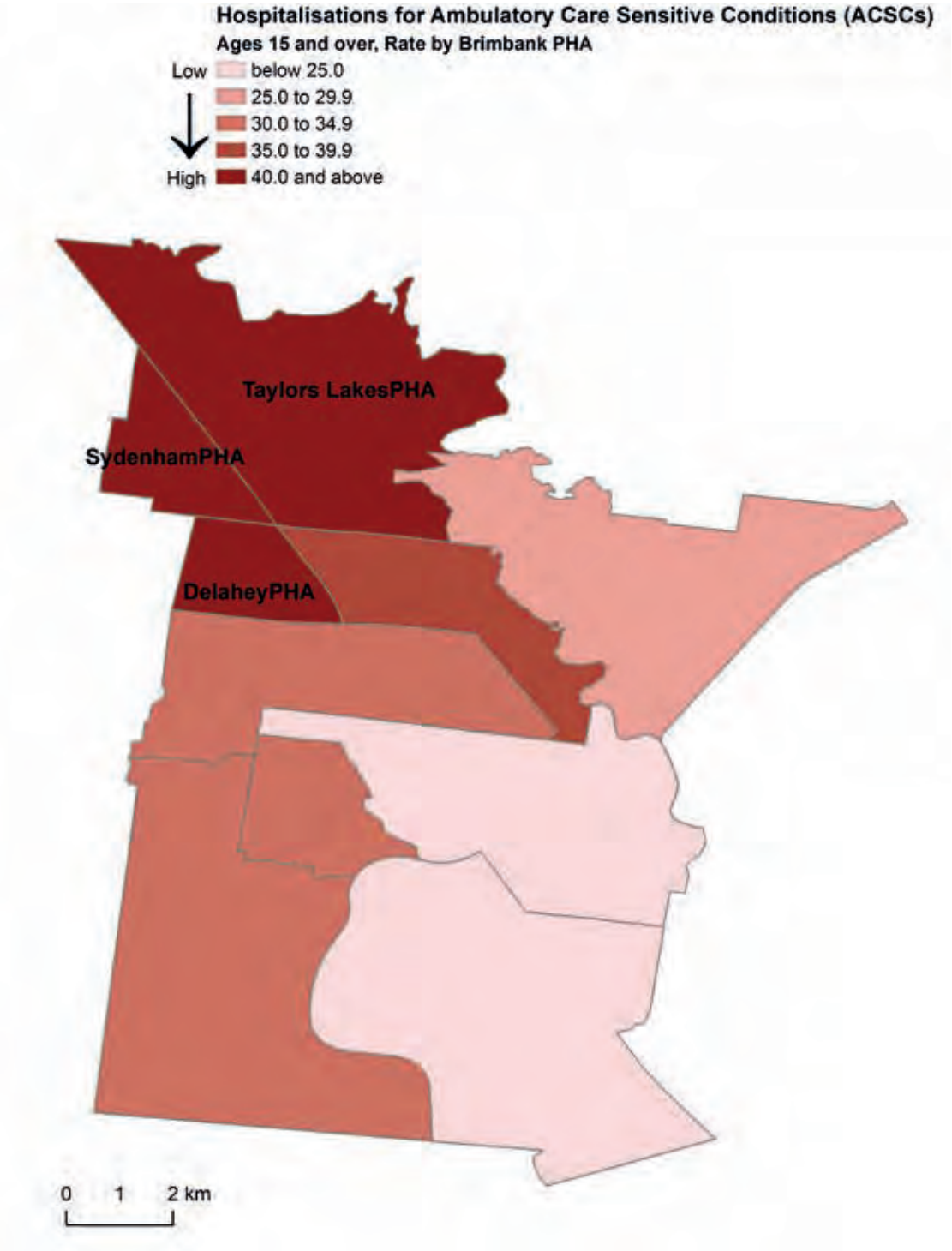
For both adults and children the association with late-opening GPs was weak to moderate.

4.5.5 Maps



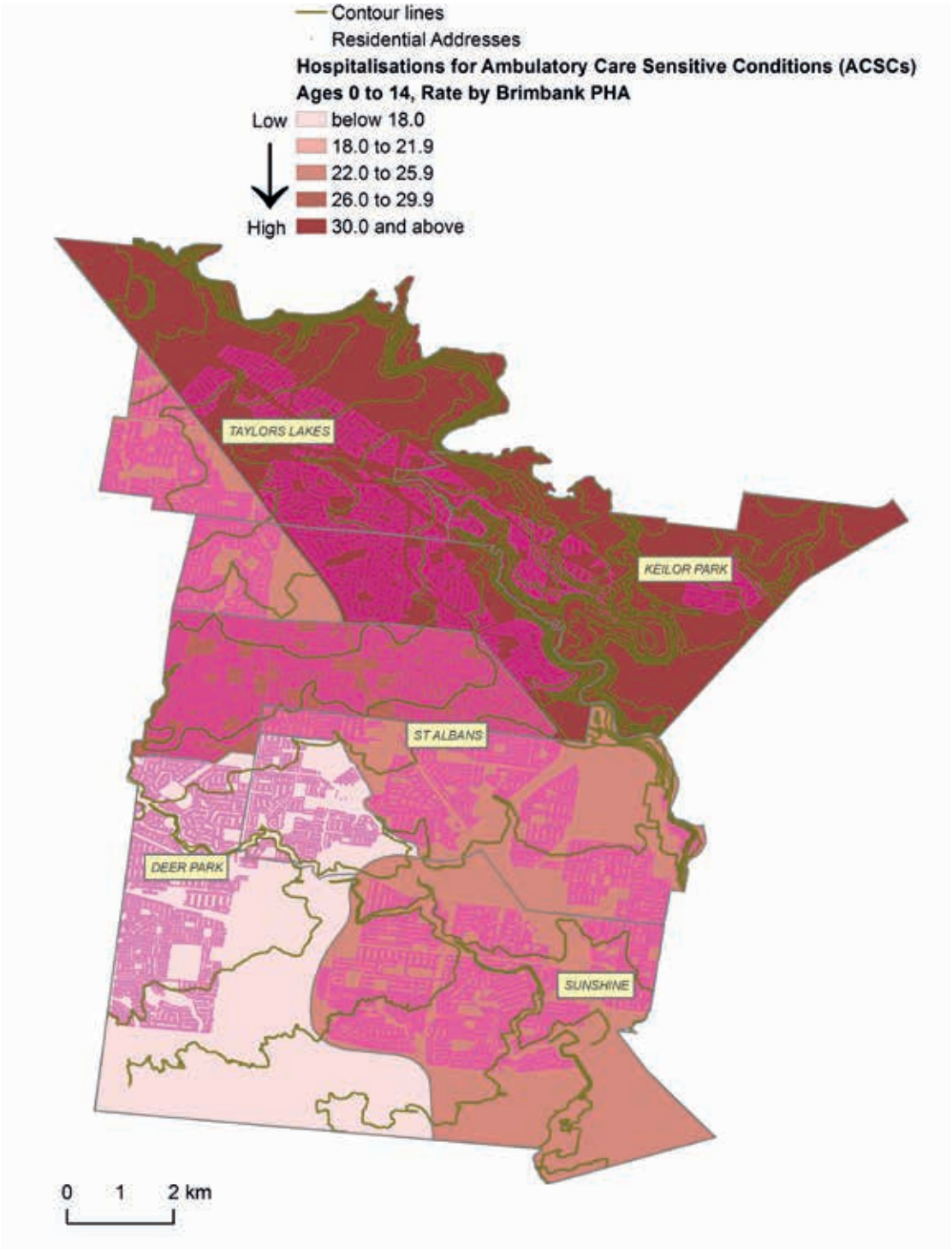
Map 4.5.1 Hospitalisation rates for ACSCs by Brimbank PHA

Ages 0 to 14 years



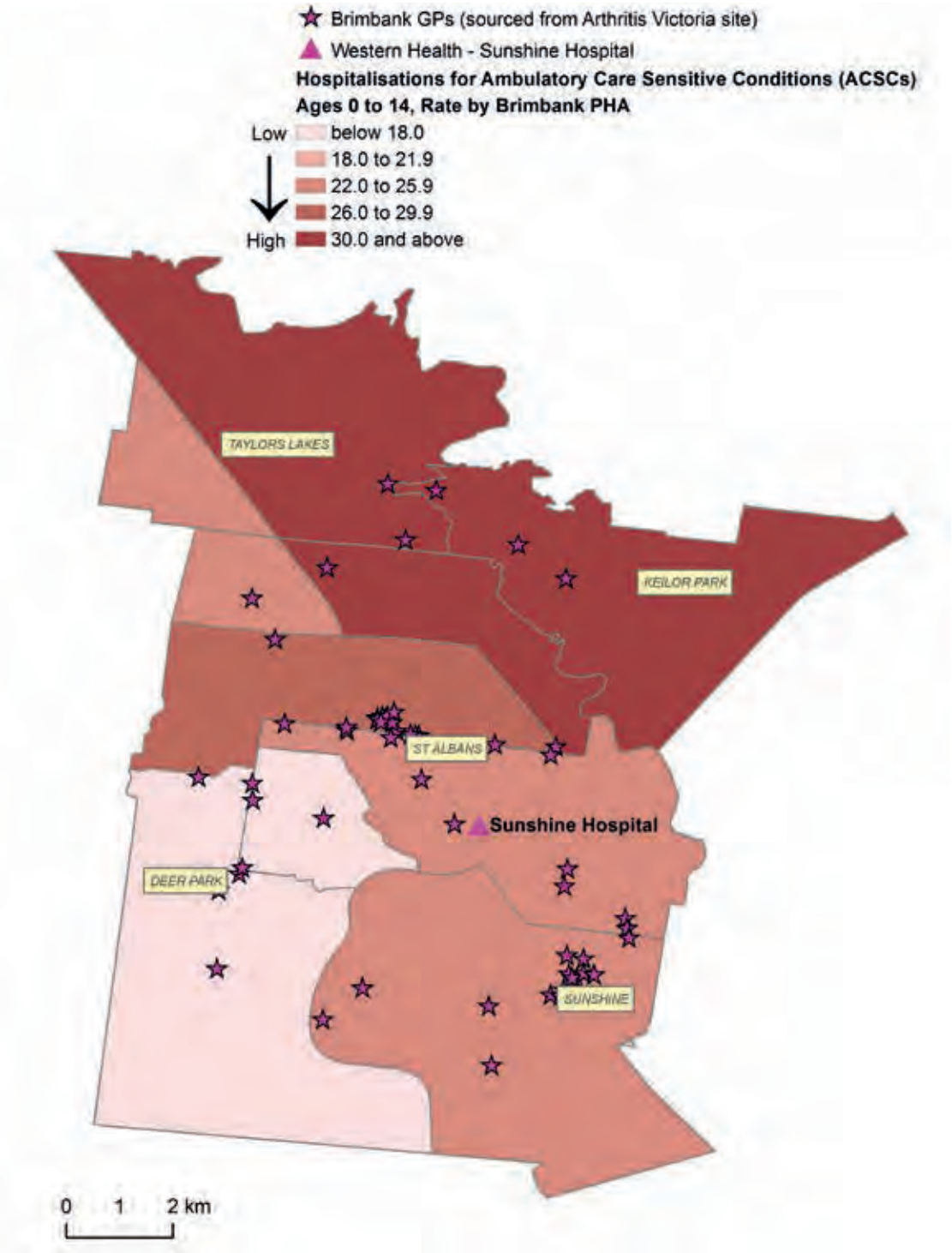
Map 4.5.2 Hospitalisation rates for ACSCs by Brimbank PHA

Ages 15 years and over. Map style from page 102–104 of Brimbank Atlas



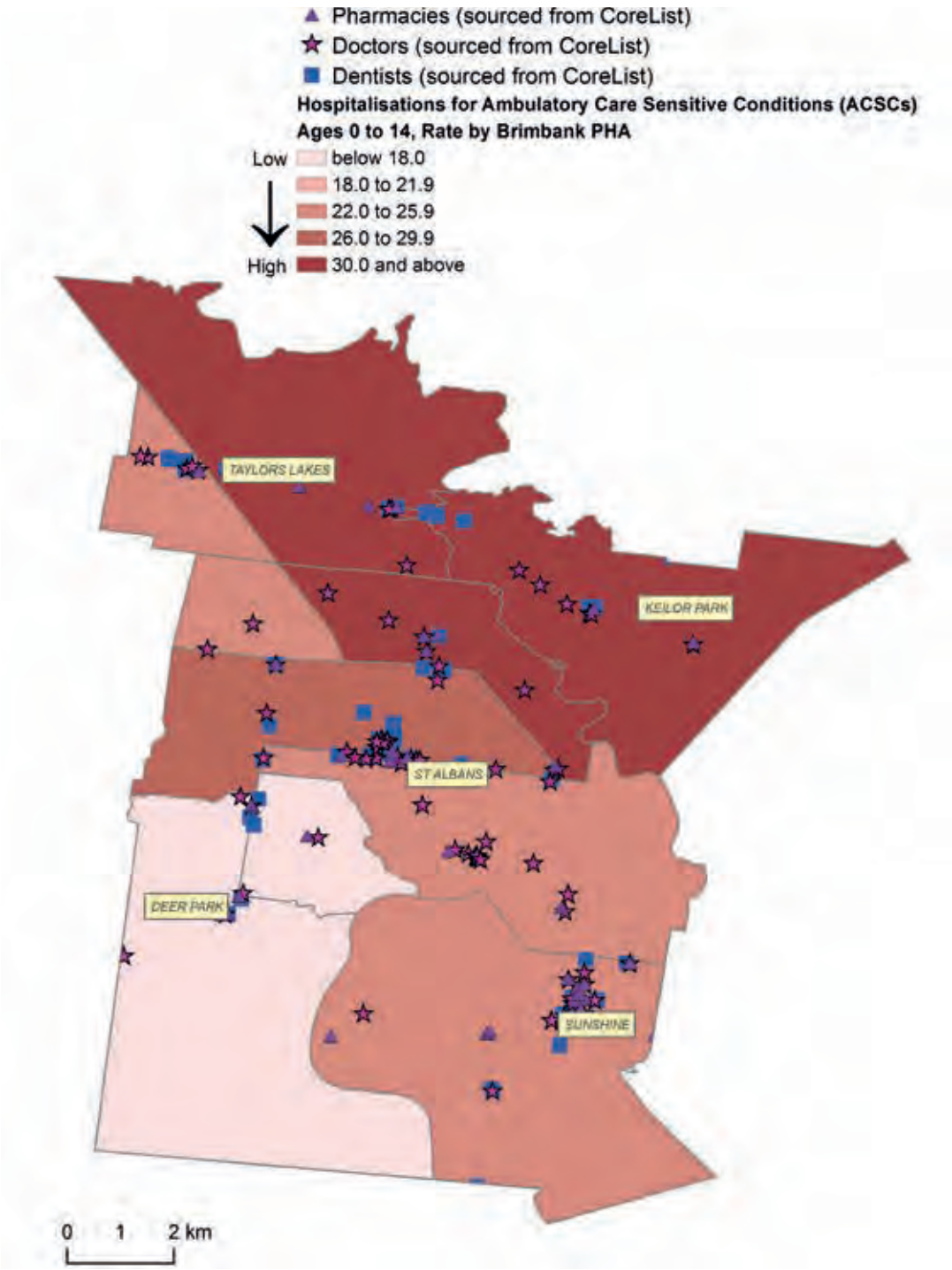
Map 4.5.3 Hospitalisations for ACSCs for ages 0 to 14

Overlay for elevation contour lines and residential addresses. Note that the Brimbank PHAs with high hospitalisation rates for ACSCs in children are concentrated around Keilor, an area with lower residential density, more contour variation, and a higher median age than the City of Brimbank as a whole.



Map 4.5.4 Hospitalisations for ACSCs for ages 0 to 14 years

Overlay for Brimbank GPs (list from Arthritis Victoria) and Sunshine Hospital. Note the large number of GPs in central St Albans. This is an area of relative socio-economic disadvantage. Also note that PHAs closer to the Sunshine Hospital do not have higher rates of ACSC hospitalisations.

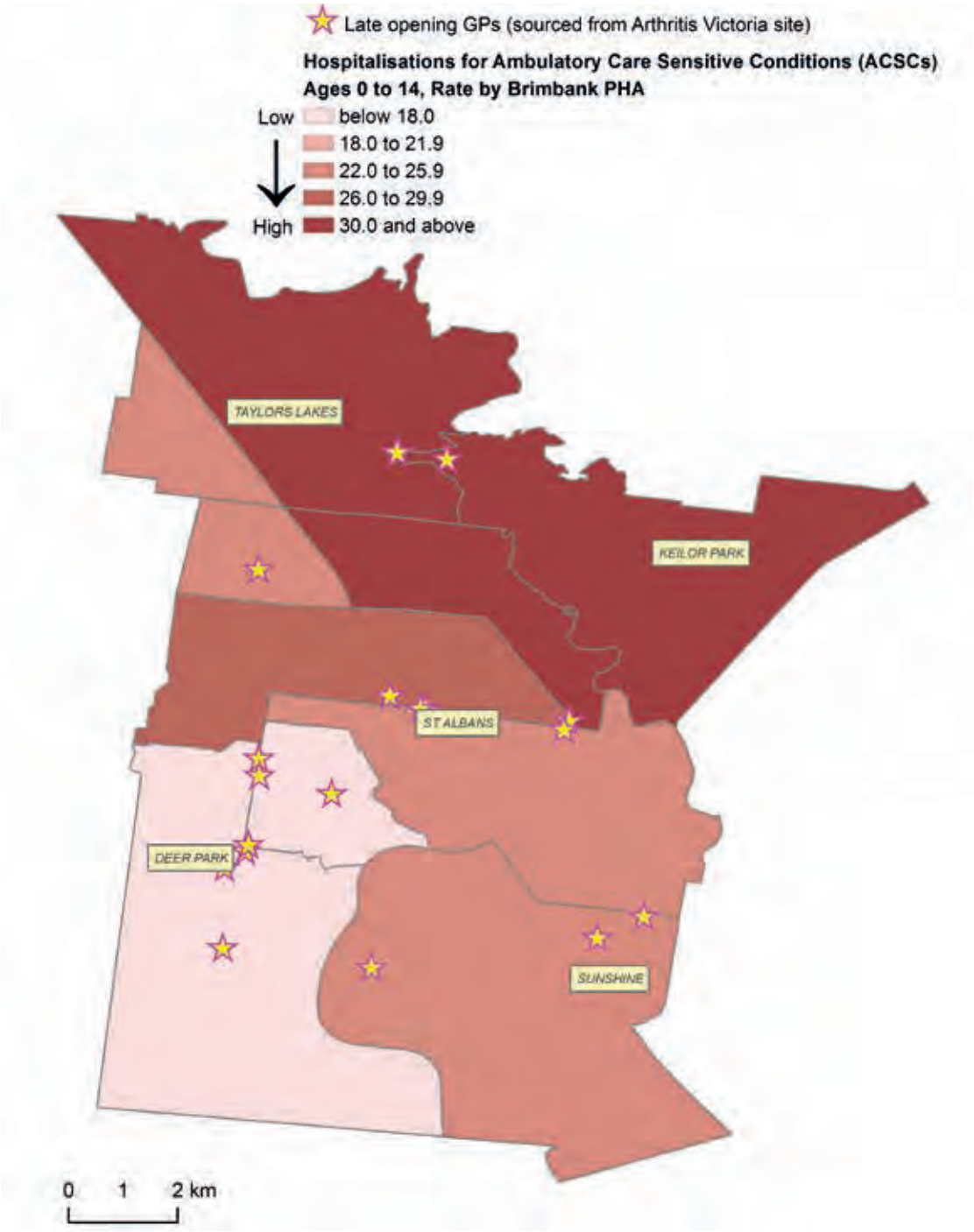


Map 4.5.5 Hospitalisations for ACSCs for ages 0 to 14

Overlay for all doctors, dentists and pharmacies listed on CoreList Australia. CoreList Australia is a commercial provider of business contact lists. There are many doctors, dentists and pharmacies listed in Brimbank, but more in the central area of Brimbank (with higher relative disadvantage) than might be expected from population alone.

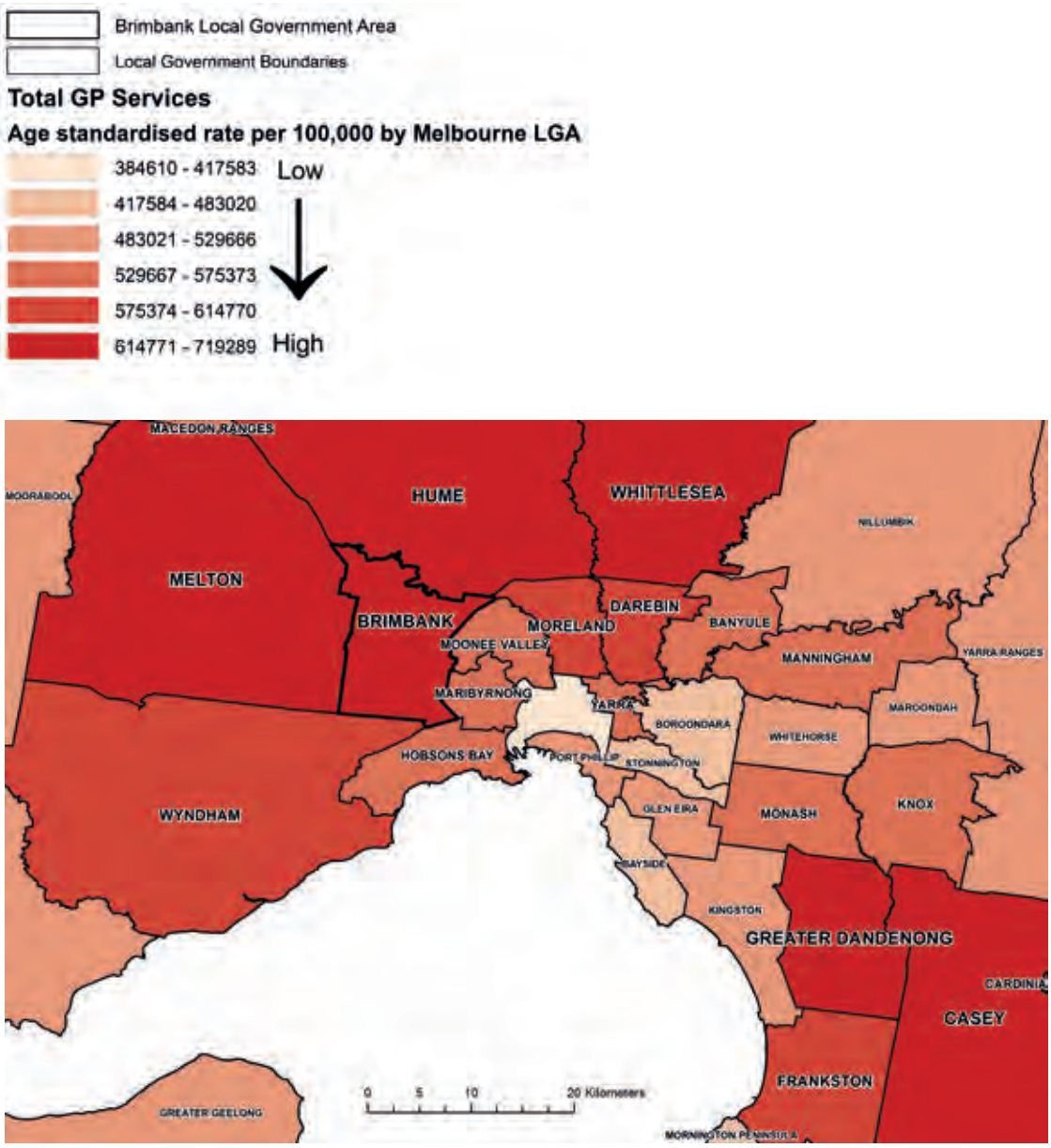
Map 4.5.6 Hospitalisations for ACSCs for ages 0 to 14

Overlay for arterial road traffic volumes. Note the high-volume roads which divide sections of Brimbank; they may influence health care providers' decisions about location and constrain residents' access



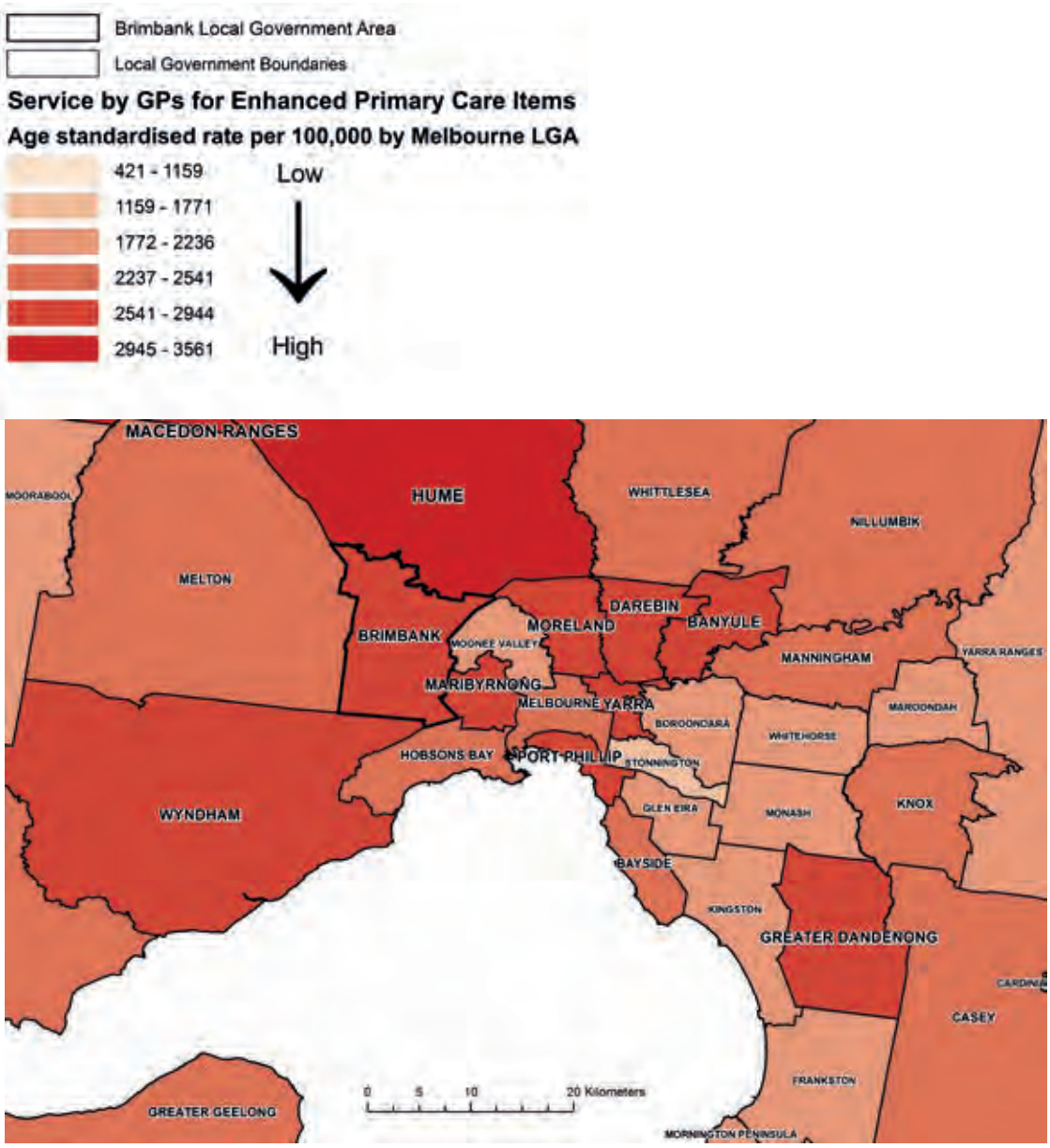
Map 4.5.7 Hospitalisations for ACSCs for ages 0 to 14

Overlay for late-opening Brimbank GPs. Note the concentration of late-opening GPs in the south-west of Brimbank, with low rates of ACSC hospitalisations for children. Of the 57 Brimbank GPs listed on the Arthritis Victoria site, 18 are open after 6pm on Monday, and 7 of these are located in the suburbs of Deer Park and Cairnlea.



Map 4.5.8 Rates of use of GP services by LGA in Melbourne

Note high rates in Brimbank, the western suburbs, Dandenong and Frankston, and relatively low rates in the inner city and eastern suburbs.



Map 4.5.9 Rates of use of GP services for EPC Items by LGA in Melbourne

Note the differences in distribution to the GP service map on the preceding page.

4.5.6 Discussion

Hospitalisations for ACSCs can be used as an indirect indicator of broader primary health care system effectiveness. They represent hospitalisations that could be prevented with consistent management of the health condition and/or earlier intervention. Avoidance of hospitalisation could occur through primary health interventions such as immunisation, or recognition of a potentially escalating condition, or case management of a chronic condition. Hence, ACSC hospitalisations are also referred to as "avoidable hospitalisations" (Hutchison et al. 2007).

Hospitalisation rates for ACSC present unusual patterns within Brimbank. While rates vary for children and adults, in both cases the highest concentrations are within the northern areas of Brimbank.

Without an obvious link to socio-economic disadvantage, the drivers of high ACSC hospitalisation rates in Brimbank are a puzzle. High hospitalisation rates may relate to demand, access or quality. When looking at areas with higher rates of hospitalisation for ACSCs, one might expect to see any or all of: higher rates of particular conditions (asthma, dental problems), triggers for these conditions (such as allergens), inaccessibility of GPs (through distance, opening hours, cost, or other social barriers), or indications that general practitioners are not providing care that prevents avoidable hospitalisations.

Potential connections between ACSCs and neighbourhoods, GP presence, GP service, and GP access are discussed in the following subsections.

Neighbourhoods

Firstly, the correlations and maps emphasise that areas with high hospitalisation rates for ACSCs in children are different to those for Brimbank as a whole: there are more hills, more conservations zones, and more pets per person, and a higher proportion of the population aged 45 to 64. These associations reflect the neighbourhood character of the PHAs of Keilor, Keilor Downs, and Taylors Lakes. They have lower residential densities and older populations than other areas of Brimbank.

The highest hospitalisation rates for adult ACSCs in Brimbank are in newer residential areas, particularly Delahey and Sydenham. Partly as an artefact of this, at Brimbank PHA level there is a positive correlation with proportions of people aged 15 to 24, and there are inverse correlations with industrial zones and residential density.

Age groups appear to be significant. The Brimbank PHAs with higher hospitalisation rates for ACSCs in children have lower proportions of children, and higher proportions of people aged 45 to 64. The Brimbank PHAs with higher hospitalisation rates for adult ACSCs have higher proportions of people aged 25 to 44.

Hence, while Brimbank as a whole has high rates of hospitalisations for ACSCs, its highest rates are in neighbourhoods that would not normally come to the attention of targeted programs for healthcare access. High rates of hospitalisations for ACSCs in children occur in areas with few children. High rates for adults occur in areas with higher rates of car ownership, and with medium levels of socio-economic disadvantage, so that cost or transport do not present obvious barriers to accessing health care.

A possible explanation derives from this neighbourhood variation itself. Brimbank is a very large LGA – the third largest by population in Victoria. It comprises areas with varying average age, income, and residential density, and different local histories (Brimbank comprises part of the former City of Sunshine in the south, and part of the former City of Keilor in the north). These areas are intersected by several large arterial roads. One hypothesis for further research is that residents may simply be unaware of healthcare providers in other areas of Brimbank, or find travelling to them inconvenient or unappealing.

General practitioners

One hypothesis was that higher hospitalisations for ACSCs are correlated with access to GPs. Map 4.5.7 shows the overlay for late-opening Brimbank GPs, which are concentrated in the south-west of Brimbank, an area with low rates of ACSC hospitalisations for children.

Whilst, the correlations are not strong, they have been included in the tables for the purpose of providing full information in the pursuit of understanding the issue better.

General Practitioners: presence

As noted previously, the most socio-economically disadvantaged PHAs in Brimbank do not have the highest hospitalisation rates for ACSCs, either in children or adults. The maps above also indicate that these central areas of Brimbank have higher numbers of GPs.

Obtaining definitive lists of health care providers can be difficult: for example, in 2013 the National Rural Health Alliance reported on difficulties in estimating the numbers of doctors in different areas of Australia (National Rural Health Alliance Inc., 2013).

For this report, data on medical practitioners were compiled from three readily available sources:

- The National Health Services Directory, accessed via the Arthritis Victoria online map;[26]
- Core List Australia;[27] and
- the Health Engine website.[28]

All these sites list medical practices, as opposed to individual practitioners, hence they are used as proxies only.

A common theme to the sources is that there is no obvious shortage of doctors in Brimbank, at least in terms of presence alone, but also that they are not evenly distributed. St Albans – the relatively disadvantaged area in central Brimbank – has more doctors than one might expect based on population alone.

On the National Health Services Directory (accessed via the Arthritis Victoria site), there are 57 general practices listed in Brimbank. Of these, 20 are located in St Albans.

CoreList contains 121 listings for medical practitioners in Brimbank, of which 53 are in St Albans. Even without counting multiple GPs operating within each practice, this is consistent with the national rate of approximately 200 GPs to 100,000 population.[29] When counting actual numbers of GPs, this rate is likely to be higher than the national average, and is higher than other areas within Brimbank. This is somewhat surprising but also consistent with other research, which has found a higher numbers of GPs in disadvantaged urban areas (Anselin 1995, Jackson et al. 2010). However, counts of dentists – a health service which does not offer bulk billing – are much lower. For comparison, the wealthy suburb of Toorak (in Melbourne's eastern suburbs) had a population of 12,871 in 2011, with 46 doctors and 40 dentists listed on CoreList. St Albans, with a population of 35,091, had 53 doctors and 24 dentists listed.

Of course, the presence of GPs does not necessarily equate to access or quality. Convenience, cost, patient choices, and quality of care also factor into health care access (Andersen 1995, Tiefelsdorf & Boots 1997). Costs of initial consultations are not an obvious factor in Brimbank, as many doctors bulk bill; this is particularly the case around St Albans. The Health Engine site advertises general practices, including a filter for billing options, and shows 20 general practices listed in Brimbank specifically advertising bulk billing options. Eight of these were in St Albans, which accounts for approximately 20% of Brimbank's population.

Opening hours of GPs were the final aspect of 'presence' examined. Practices open after 6pm on Monday were used as a proxy to explore this theme.

Map 4.5.7 shows late-opening GPs. Unlike other doctors, these are not concentrated in St Albans, but rather in the south-west of Brimbank around Cairnlea and Deer Park, areas with low rates of hospitalisations for ACSCs in children. This map indicates a need to test the hypothesis that hospitalisation rates for ACSCs in children are lower where there is greater access to late-opening GPs.

26 www.arthritismap.com.au The Arthritis Map includes data sourced from the National Health Service Directory (NHSD), as well as other services of interest for people with musculoskeletal conditions.
27 www.corelist.com.au Core List Australia is a commercial provider of business lists, whose products include addresses and geographic coordinates of doctors, dentists and pharmacies throughout Australia
28 www.healthengine.com.au Health Engine is an online service to find and book medical appointments.
29 See Australian Bureau of Statistics, "Doctors and Nurses", April 2013: www.abs.gov.au/AUSSTATS/abs@.nsf/ookup/4102.0Main+Features20April+2013

General Practitioners: Service rates

Other lines of enquiry for primary health care provision are briefly explored in the two maps below. For example, there are many GPs in Brimbank – does this translate to high use? Extra data at LGA level was gathered to explore this. Map 4.5.8 shows rates of GP use in Melbourne LGAs. The map suggests that GP services are accessed at a relatively high rate in Brimbank, as in several other outer-suburban LGAs like Hume and Whittlesea.

Secondly, the GP service map does not reveal the types of GP service being accessed, which could range from short procedures to more extended services. While it is problematic to quantify levels of primary health services, one simple proxy measure (noting that these are now Chronic Disease services) is the rate of GP provision of *Enhanced Primary Care Products*,[30] as described below.

> *In 1999/2000, the Federal Government introduced Enhanced Primary Care (EPC) items to the Medicare Benefits Schedule (MBS). These items were designed to improve care of persons with chronic and/or complex conditions and to remunerate GPs for services, including contributing to the care of such persons outside the normal face-to-face consultation process.*[31] *(Public Health Information Development Unit, 2016)*

Map 4.5.9 shows rates of provision of EPC products by GPs in Melbourne LGAs. Here, the distribution across Melbourne looks different to those for GP services in general, with less skew towards the western suburbs and higher rates in the inner city. This suggests that higher levels of GP service provision and high numbers of GPs do not equate to a higher level of care. This is another area requiring more research. Further exploration could exploit a better quality measure than EPC items, namely short and long consults for conditions such as asthma.

General practitioners: access

Maps 4.5.4 and 4.5.5 show the locations of GP services in Brimbank. They are reasonably widely geographically distributed, although some clustering exists in St Albans and Sunshine.

Whilst the correlation between late-opening GPs and hospitalisation for ACSCs is moderate for 0–14-year-olds, it is weak in adults. Therefore, the lines of enquiry regarding ACSCs must encompass more than access to GPs.

The overlay of traffic volumes (Map 4.5.6) provides insight into another complexity of Brimbank residents' access to GP services, to early intervention primary health care, and to hospital care.

Several high-volume roads separate or divide PHAs in Brimbank. The major separations are:

- St Albans (which has the highest concentration of GPs and bulk billing GPs from other areas of less provision) from other PHAs via a NW–SE divide; and
- the outlier PHAs, such as Taylors Lakes and Deer Park, from more centrally placed and concentrated services within Brimbank.

Late-opening GP surgeries (after 6pm) may be affected by end-of-workday traffic. However, 18 of the 57 GPs listed offer late opening hours, and there is a concentration (seven) in Deer Park and Cairnlea, both of which show lower ACSC hospitalisation rates for children.

30 Now named Chronic Disease Management Services
31 www.phidu.torrens.edu.au/notes-on-the-data/health-services/epc-attendances-other

4.6 Children developmentally vulnerable on one or more domain

4.6.1 Summary box

The Australian Early Development Census (AEDC) is a nationwide survey of children in their first year of school. The data are collected from checklists completed by teachers. The results can be used as a measure of school readiness.

In 2012, while the majority of first-year schoolchildren in Brimbank were assessed as being 'on track' in the physical health and wellbeing domain and in the language and cognitive skills domain, over one quarter (28%, 594 children) were assessed as being developmentally vulnerable on one or more of the five AEDC domains. The highest concentration of children assessed as developmentally vulnerable children was in the Delahey PHA.

Government and not-for-profit services and facilities of relevance to children are distributed throughout Brimbank and show no correlations with children developmentally vulnerable on one or more domains. These features include libraries, maternal child health services, state primary schools, kindergartens, neighbourhood playgrounds, toy libraries, playgroups, sports fields, and municipal aquatic centres.

While government and not-for-profit services are distributed on the basis of population, commercially run providers tend not to be located in vulnerable areas. This is reflected in the distribution of indoor play centres and private swim schools. However, the same is not true for bottle shops: in 2012, children assessed as developmentally vulnerable in Brimbank lived in areas with significantly greater proximity to packaged liquor licenses.

Women's perceptions of safety in Brimbank (see section 4.1.6, page 64, and 4.2.6, page 88) can also impact children's use of public space and services.

Rates of children who are developmentally vulnerable are higher in areas with more recent arrivals from NES countries.

4.6.2 Children developmentally vulnerable in one or more domain

The *Brimbank Atlas of Health and Education* includes information from the 2012 Australian Early Development Index, a nationwide survey of children in their first year of school. In 2014 the Index was renamed the Australian Early Development Census, and is referred to in this report as the AEDC.

The AEDC was conducted in 2009, 2012, and 2014. It presents a uniquely comprehensive nationwide dataset on child development, which in 2012 comprised 289,973 children, or 96.5% of the eligible population (Brinkman et al. 2014). The data are collected from checklists completed by teachers of first-year schoolchildren after at least one month of observation.

The dataset measures five areas (domains) of early child development: physical health and wellbeing, social competence, emotional maturity, language and cognitive skills (school-based), and communication skills and general knowledge.

In the *Brimbank Atlas of Health and Education*, AEDC results were presented in two sections:

1. Pages 134–136, **'on track'**:

   Children in their first year of school assessed as being on track in the physical health and wellbeing domain (1715 children / 79.1% of children in the first year of school in Brimbank, compared to 81.2% Australia-wide), and in the language and cognitive skills domain (1678 children / 77.4% of children in the first year of school in Brimbank, compared to 82.6% Australia-wide).

2. Pages 138–139, **'vulnerable'**:

   Children in their first year of school assessed as being vulnerable on one or more of the five domains (594 children / 27.7% of children in first year of school in Brimbank, compared to 22.0% Australia-wide).

While most first-year schoolchildren in Brimbank were assessed as being 'on track' in the physical health and wellbeing domain and in the language and cognitive skills domain, over one quarter (27.7%, 594 children) were assessed as being developmentally vulnerable on one or more of the five AEDC domains. This proportion is much higher than in Melbourne overall (19.3%), and higher than Australia overall (22.0%). The Sunshine SLA was ranked the seventh highest in Melbourne, and the Keilor SLA was ranked ninth highest in Melbourne.

At PHA level within Brimbank, the distribution of developmentally vulnerable children was uneven, and varied slightly from the distribution patterns of the IRSD. Two Brimbank PHAs had rates of developmentally vulnerable children well below the national and Melbourne rates (Keilor and Taylors Lakes, with 15.4% and 15.1%, respectively). These are also the two Brimbank PHAs with the least socio-economic disadvantage.

The highest rate of developmentally vulnerable children in Brimbank was in the Delahey PHA, a relatively new residential area with a medium score for socio-economic disadvantage. In Delahey, 34.5% of first-year schoolchildren in 2012 were assessed as vulnerable on one or more AEDC domain. This was a quarter above the Brimbank-wide rate, and well above Melbourne and Australian rates.

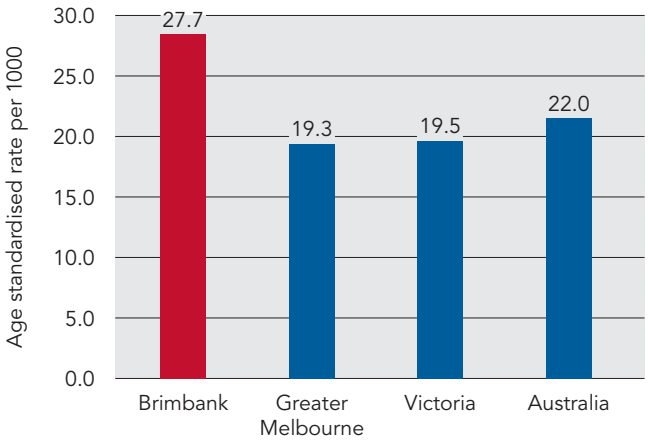


Figure 4.6.1 Children developmentally vulnerable on one or more domains (AEDC) 2011–12

4.6.3 Correlations at Brimbank Population Health Area level

Children developmentally vulnerable on one or more domain (2012 AEDC)
Positive correlations at Brimbank PHA level These attributes are MORE PREVALENT in Brimbank PHAs with high rates of children developmentally vulnerable on one or more domain
Physical and social infrastructure Packaged liquor licenses – proximity to residences (.947**) State primary schools – proximity to residences (.927**) Bulk-billing GPs – proximity to residences (.871**) Late-opening GPs – proximity to residences (.486) **Health and wellbeing indicators** Estimated rates of self-assessed poor or fair health (.774**) Estimated rates of male smokers (.763*) People aged under 65 living with a disability – percentage (.675*) Estimated rates of psychological distress (.648*) Estimated rates of harmful alcohol use (.639*) Estimated rates of diabetes (.636*) **Contextual indicators** Dwellings in rental stress (.892**) Dwellings in mortgage stress (.874**) Percentage born in NES country (.872**) Socio-economic disadvantage (.808**) Percentage of jobless families (.739*) Percentage of single-parent families (.718*) **Education and child development** Rates of early school leavers (.658*) **Demographics** [no significant results]

Children developmentally vulnerable on one or more domain (2012 AEDC)

Inverse correlations at Brimbank PHA level

These attributes are LESS PREVALENT in Brimbank PHAs with high rates of children developmentally vulnerable on one or more domain

Physical and social infrastructure

Conservation zones – total sqm per person (-.905**)

Percentage of parkland (-.867**)

Conservation zones – per person (-.846**)

Trees [open space] – per person (-.826**)

Fitness businesses [all] – per person (-.822**)

Bike track on road – total m per person (-.818**)

Trees [on street and open space] –per person (-.812**)

Licensed restaurants and cafes – per person (-.791**)

Public toilets – per person (-.790**)

Contour variation (-.777**)

Gyms – per person (-.749*)

Trees [street] – per person (-.723*)

Late-opening GPs – proximity to residences of children developmentally on track – language and cognition skills (-.717)

Indoor play centres – proximity to residences (-.718*)

Drinking fountains – per person (-.696*)

Pets – per person (-.675*)

Bike paths off road – total m per person (-.666*)

Hotels – per person (-.662*)

Women's gyms – per person (-.662*)

Playgrounds [flagship] – per person (-.658*)

Take-away food outlets [all] – per person (-.643*)

Cafes – per person (-.641*)

Take-away food outlets [chain] – per person (-.635*)

Walking school bus stops – per person (-.632*)

Late-opening GPs – per person (-.083)

Health and wellbeing indicators [no significant results]

Contextual indicators

People engaged in voluntary work (-.799**)

Education and child development

Children developmentally on track – physical health (-.811**)

Children developmentally on track – language and cognitive skills (-.782**)

Demographics [no significant results]

4.6.4 Summary of the correlations

In the Brimbank PHAs with higher estimated rates of ***children developmentally vulnerable on one or more domains,*** there are also higher estimated rates of self-assessed poor or fair health, male smokers, psychological distress, harmful alcohol use, and diabetes, and strong associations with the following physical and social infrastructure (assets or deficits) and contextual indicators.

Infrastructure

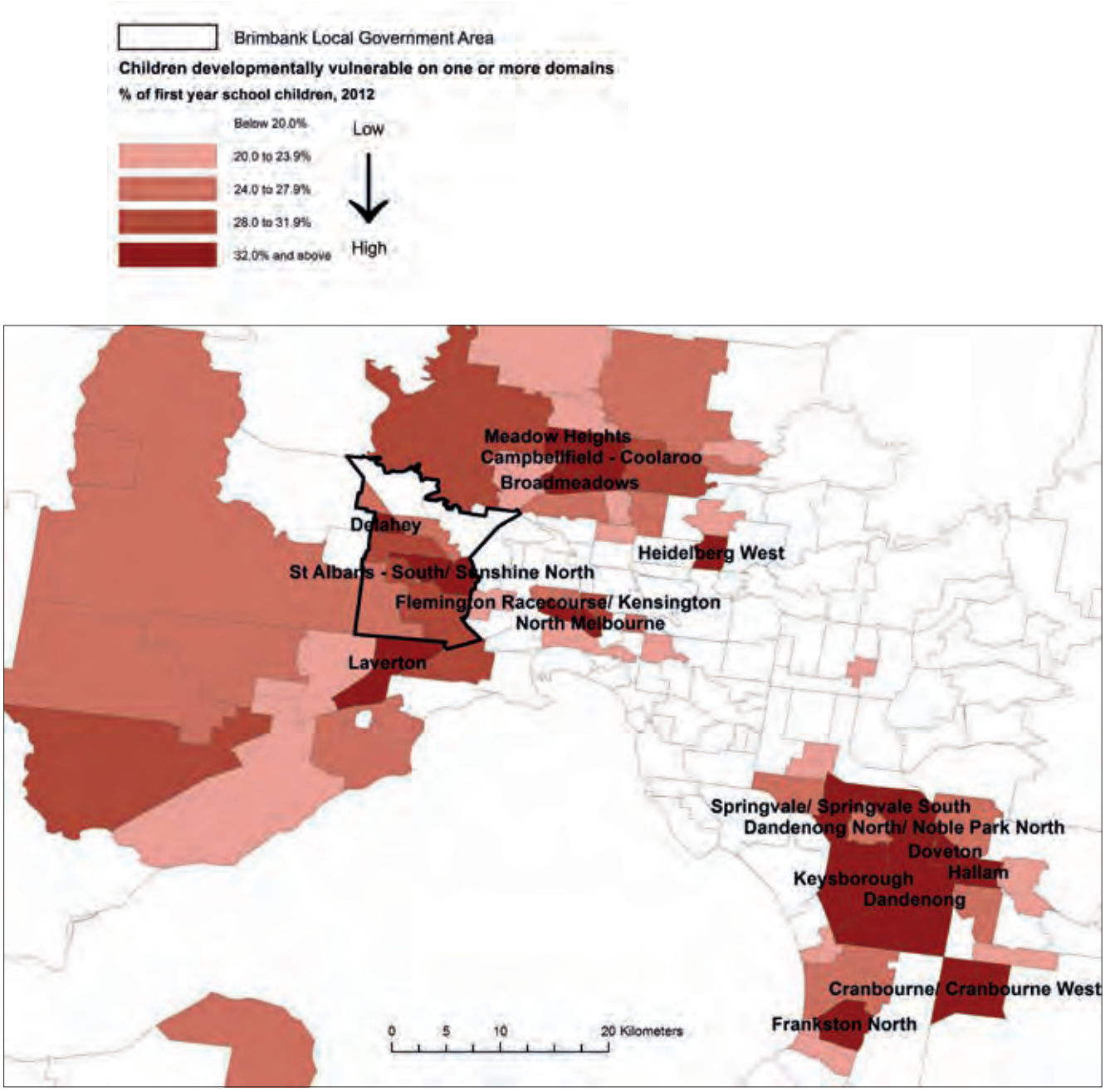
- Much greater proximity of residences to packaged liquor licenses, state primary schools, and bulk-billing GPs (but not particularly late-opening GP surgeries).
- Lower proportions of people engaged in voluntary work.
- Less parkland.
- Fewer conservation zones, trees, fitness businesses, bike paths, licensed restaurants and cafes, public toilets, gyms, drinking fountains, pets, chain take-away food outlets, and walking school bus stops per person.
- Greater distances from indoor play centres.
- Fewer hills.
- Less proximity of late-opening GPs to residences, specifically in relation to better language and cognition skills.

Context

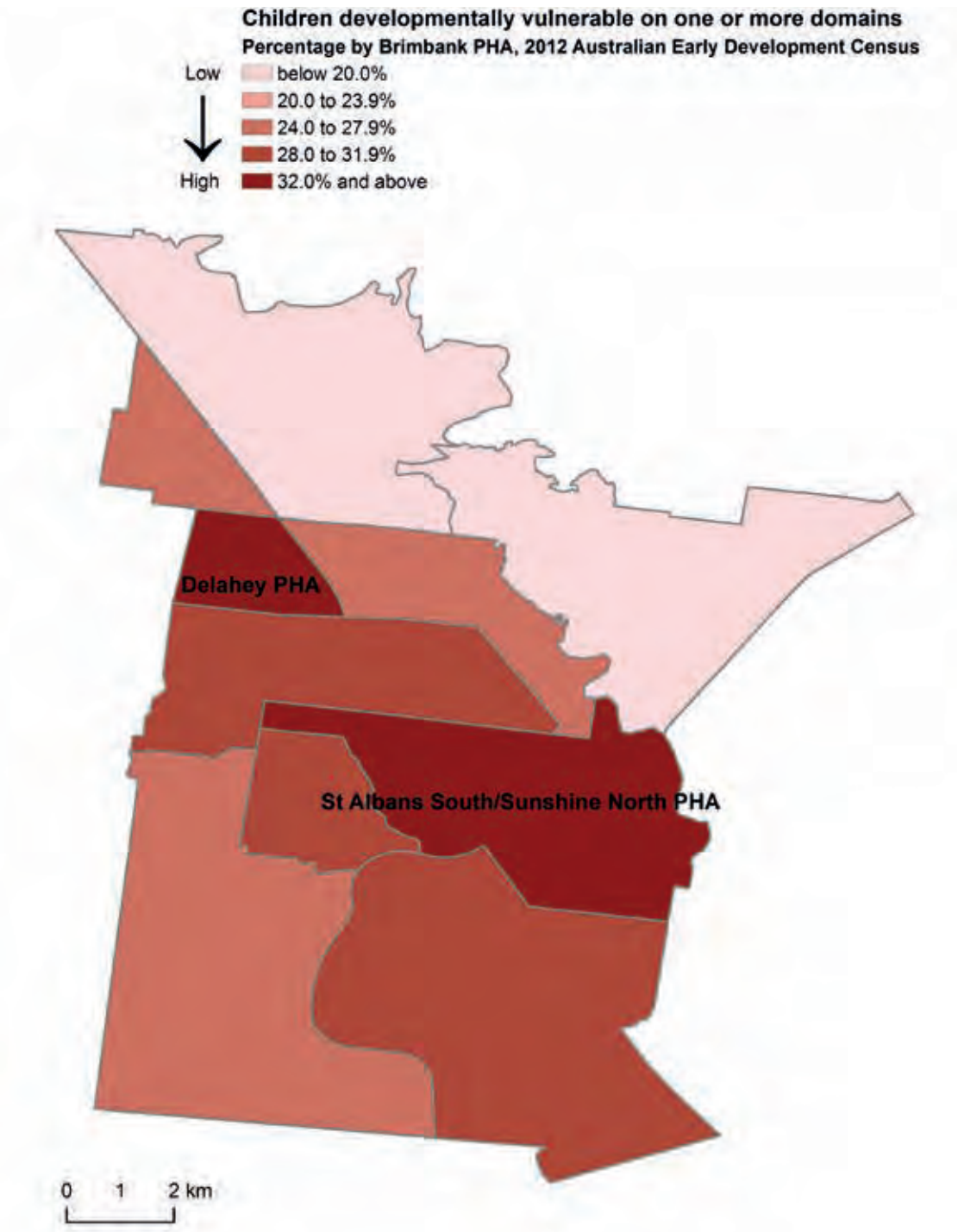
- More people aged 65 years and under living with a disability.
- Higher proportions of dwellings in rental stress, dwellings in mortgage stress, people born in NES countries, jobless families, and single-parent families.
- Greater socio-economic disadvantage.
- Higher proportions of early school leavers.

Unlike hospitalisations for ACSCS, higher rates of childhood vulnerability are strongly associated with more bulk billed GPs and moderately with late-opening GPs; the inverse correlation with better language and cognition skills will be explored. Maps 4.6.1–4.6.12 show data for children developmentally vulnerable by Melbourne PHAs and Brimbank PHAs, and overlays of key indicator data.

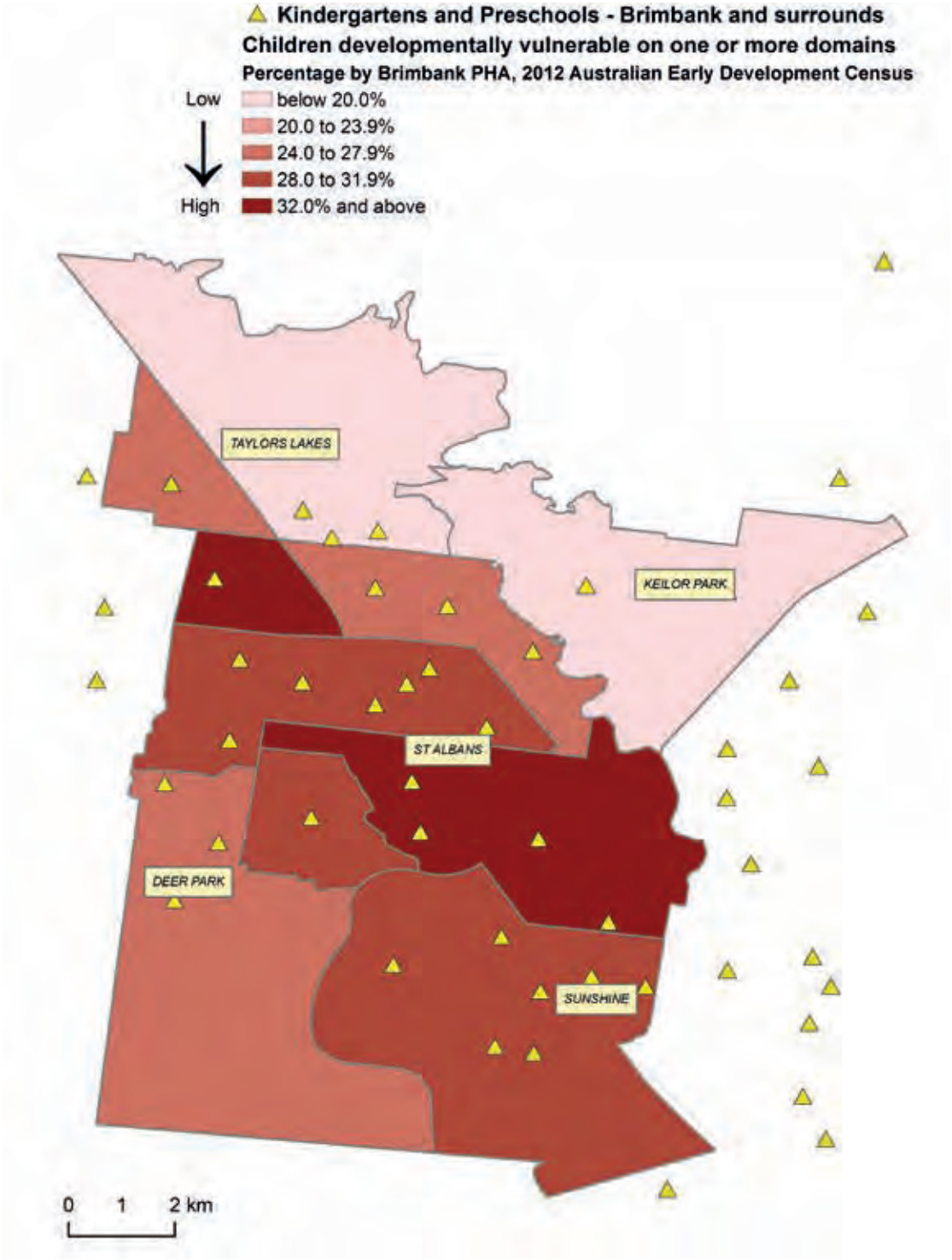
4.6.5 Maps



Map 4.6.1 Children developmentally vulnerable on one or more domains, by Melbourne PHA

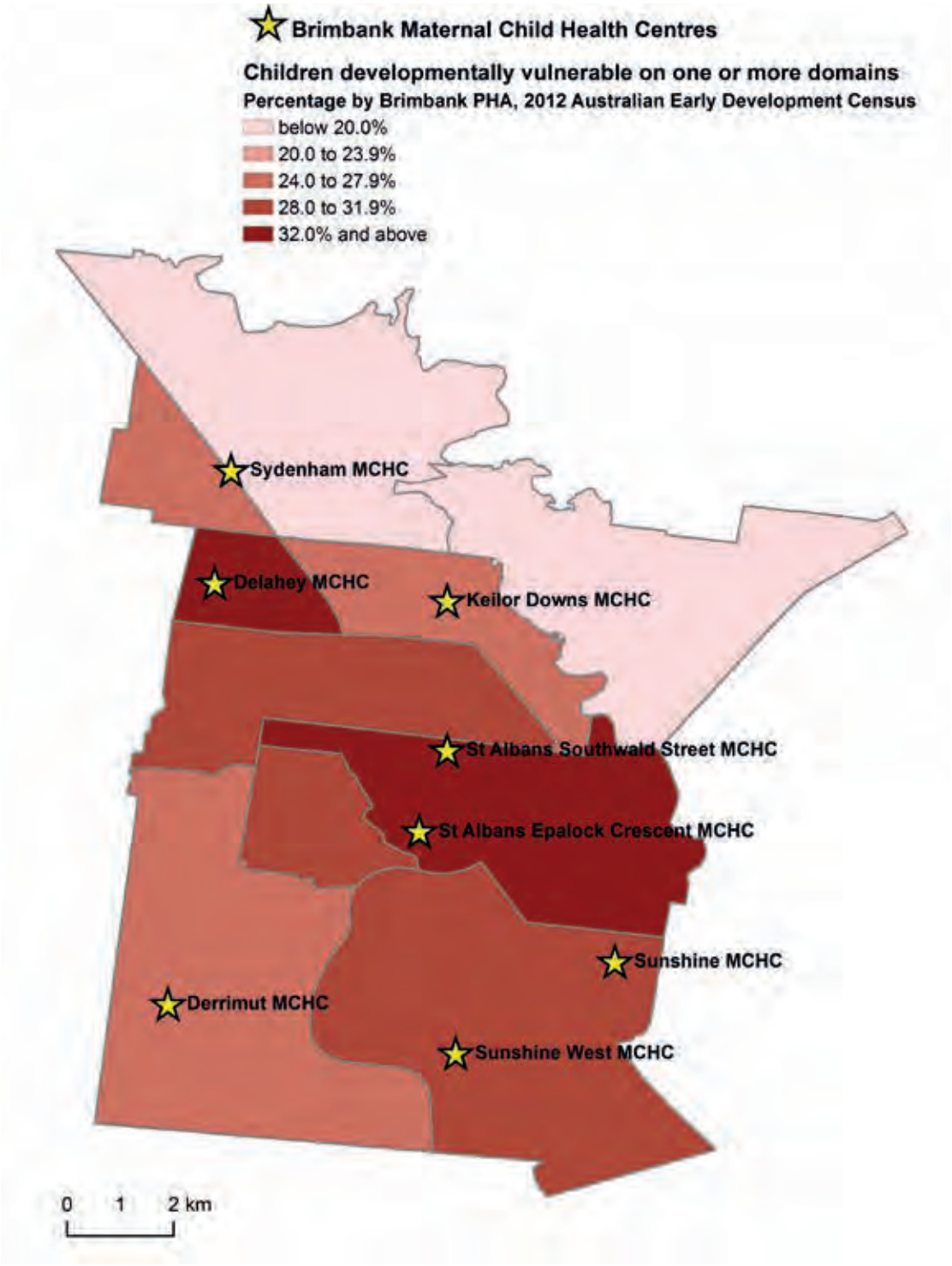


Map 4.6.2 Children developmentally vulnerable on one or more domains, by Brimbank PHA



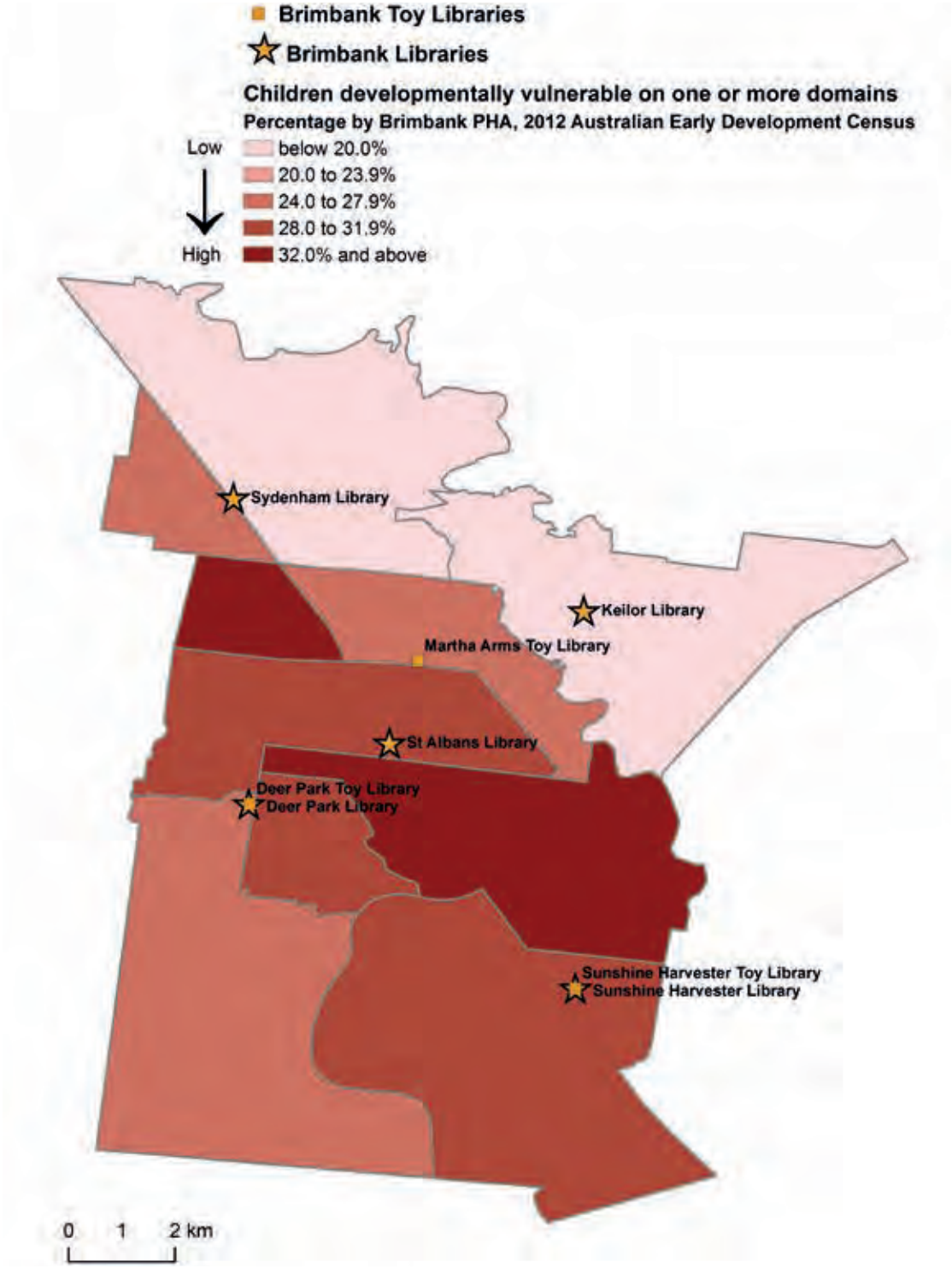
Map 4.6.3 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for kindergartens and preschools



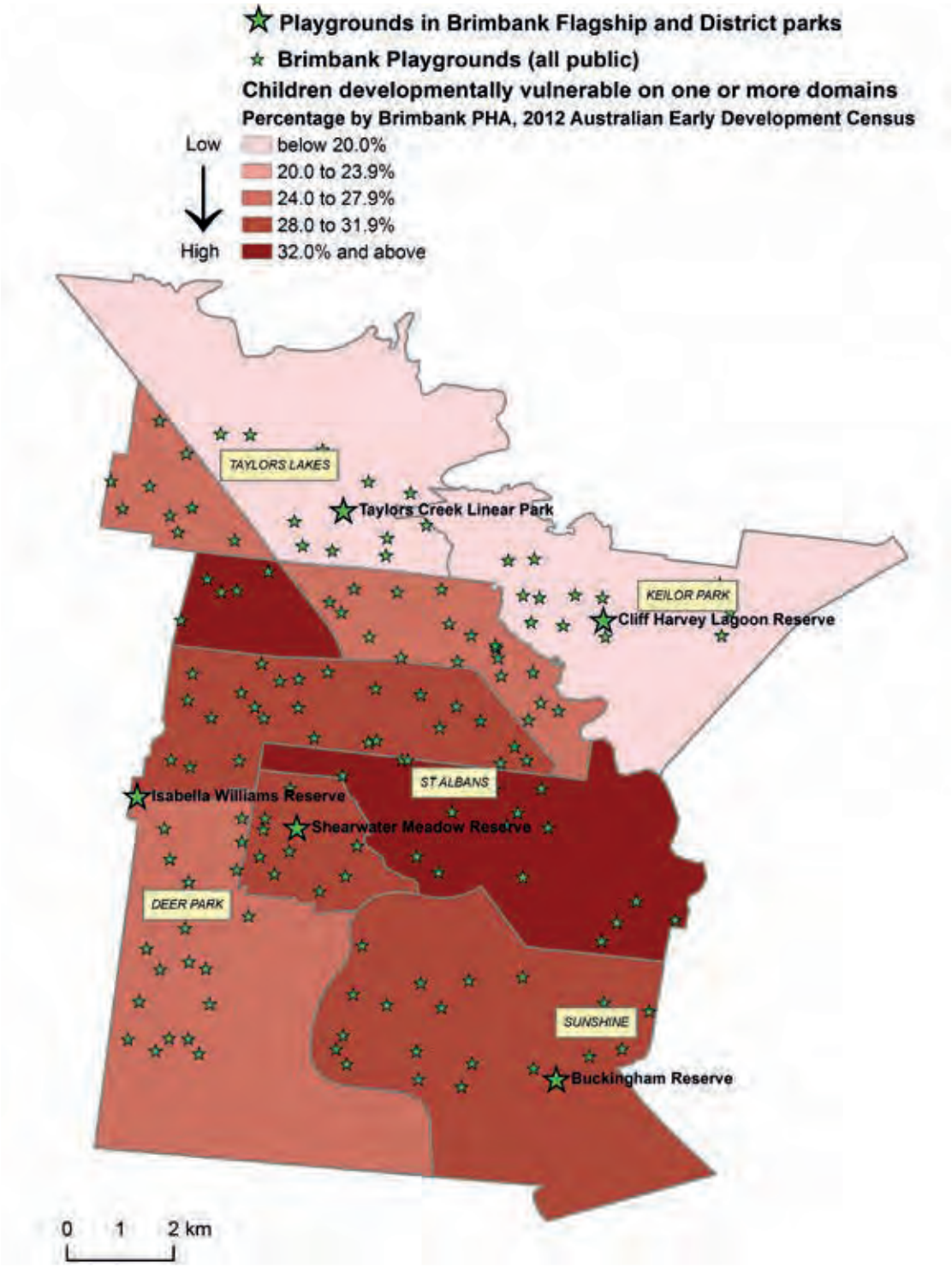
Map 4.6.4 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for Brimbank Maternal and Child Health Centres



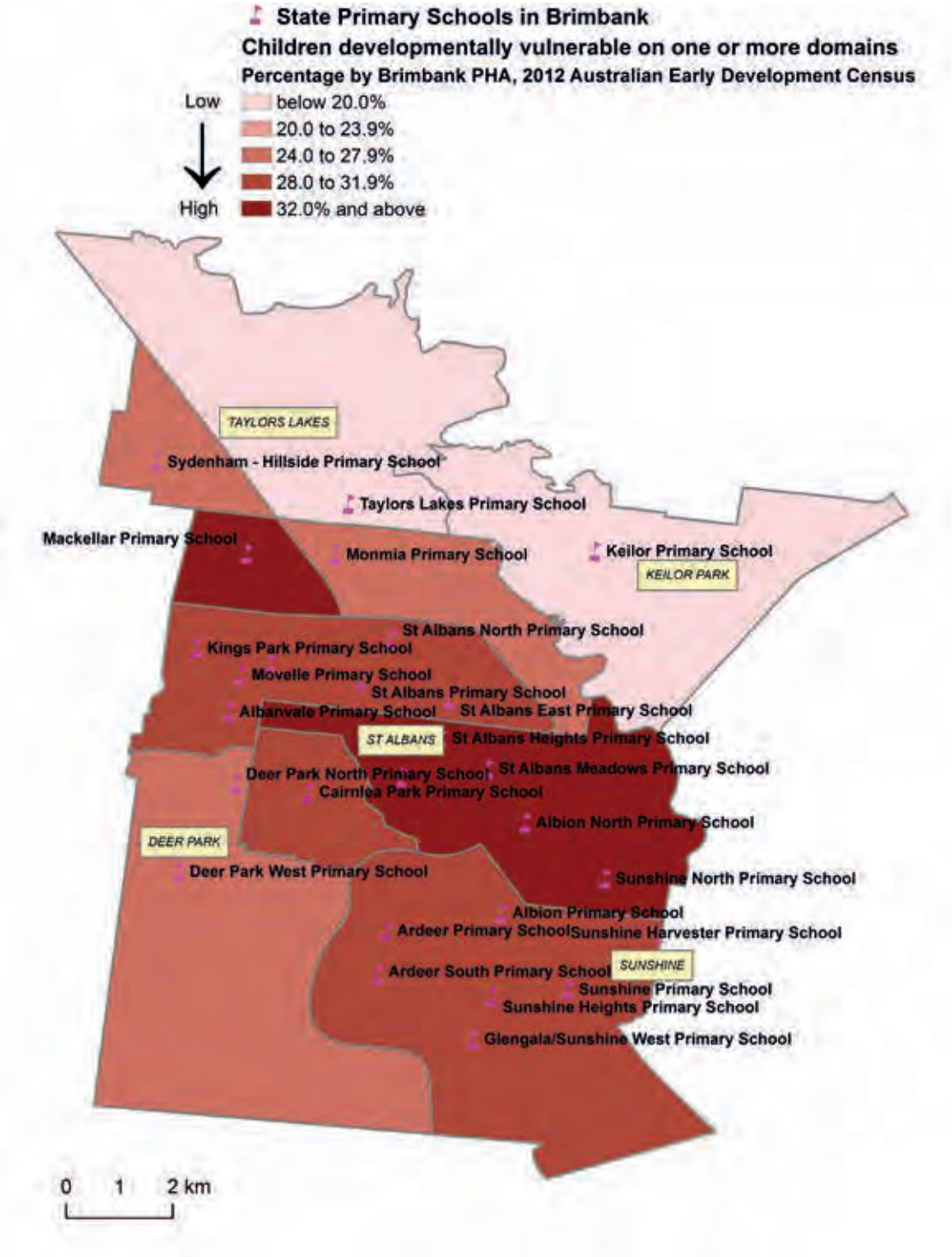
Map 4.6.5 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for Brimbank libraries and toy libraries



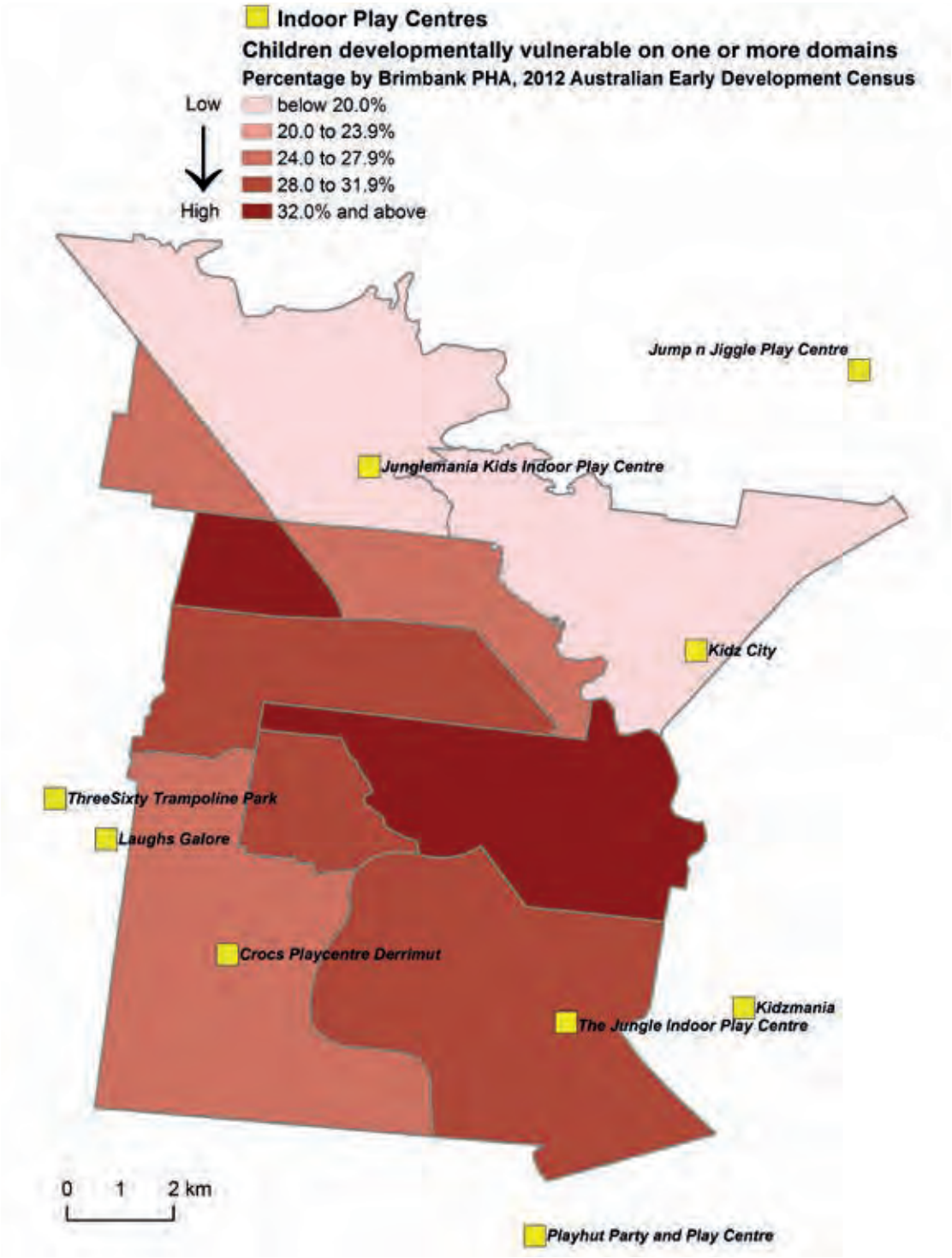
Map 4.6.6 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for all public playgrounds, with the large district and flagship parks in bold. There are many playgrounds across Brimbank, with most blank areas being industrial zones. However, five of Brimbank's 10 PHAs lack a larger playground in a Flagship or District park.



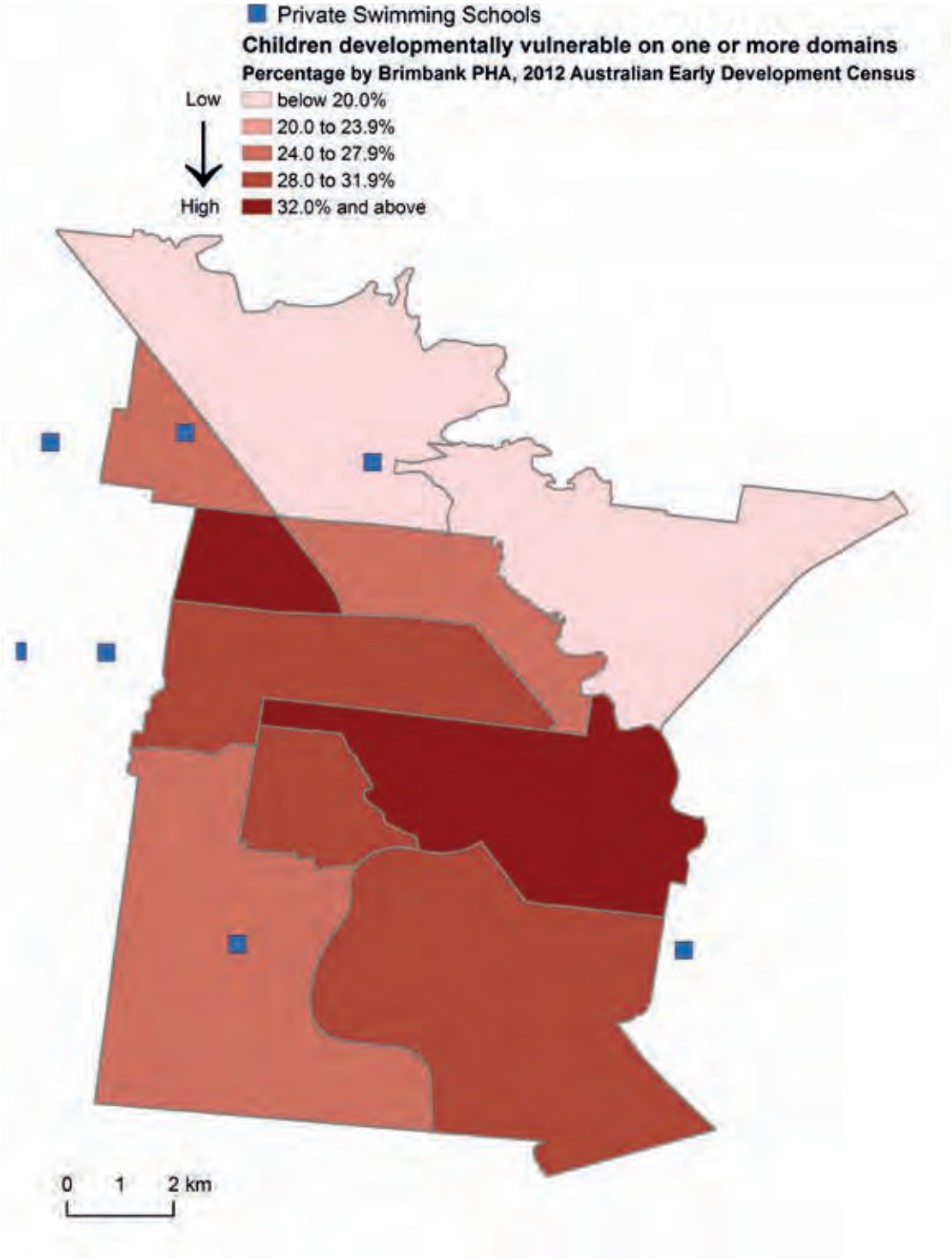
Map 4.6.7 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for state primary schools. There are many state primary schools in Brimbank, and many in the central areas.



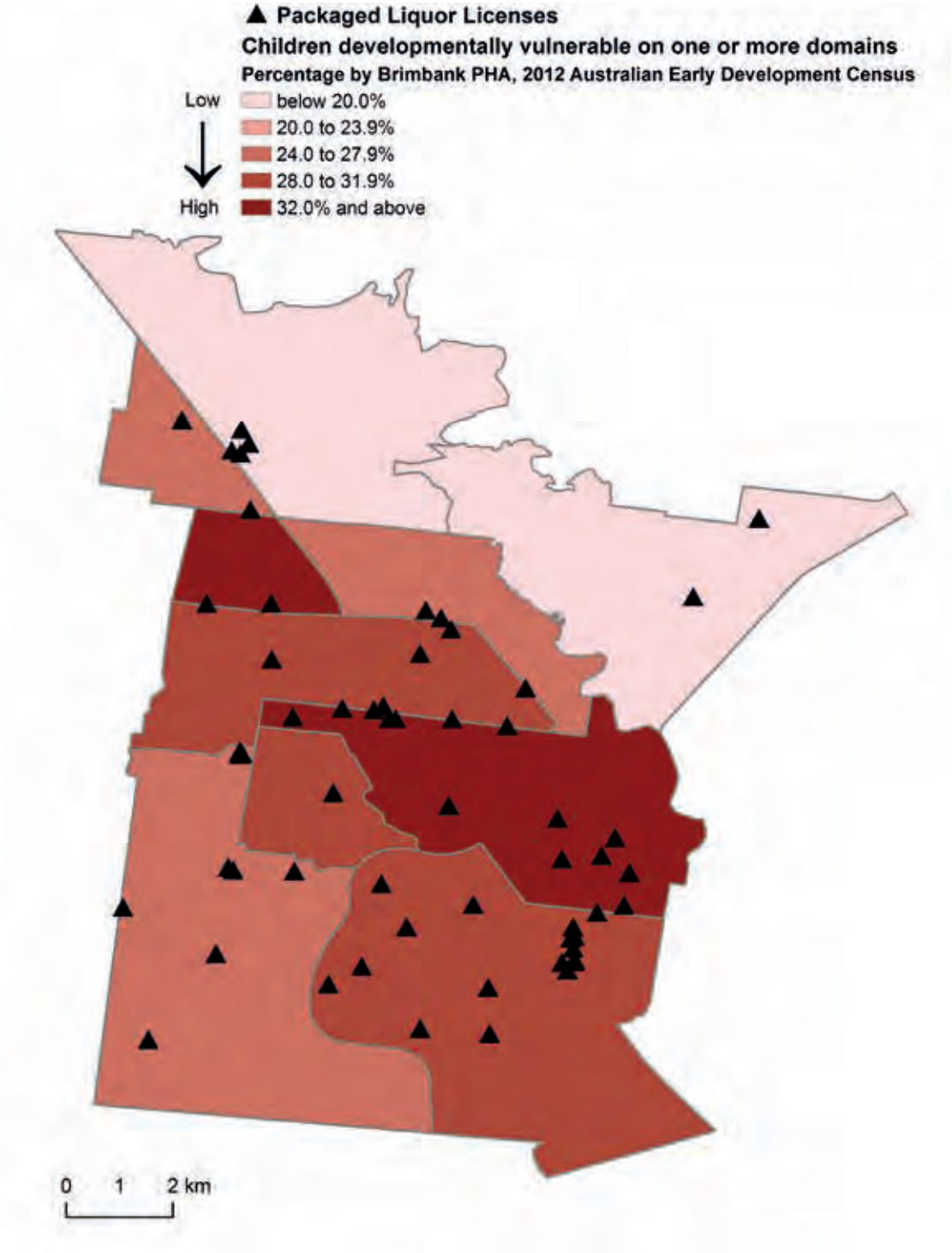
Map 4.6.8 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for indoor play centres. Six of Brimbank's 10 PHAs lack an indoor play centre.



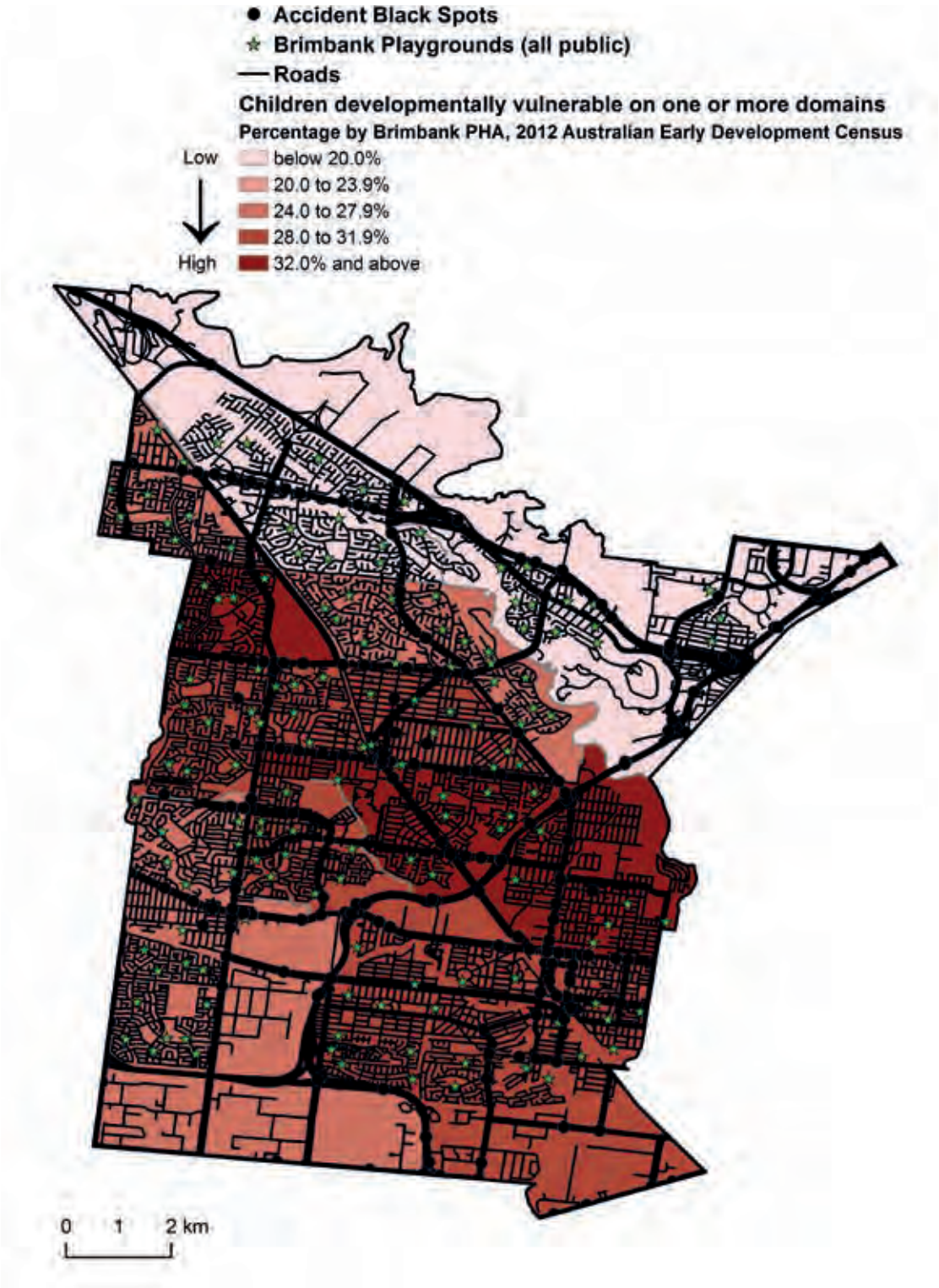
Map 4.6.9 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for private swim schools. There are few private swimming schools in central Brimbank. St Albans Leisure Centre (run by Brimbank City Council) is the closest swimming pool for many Brimbank residents. See Map 4.2.12 for municipal aquatic centres.



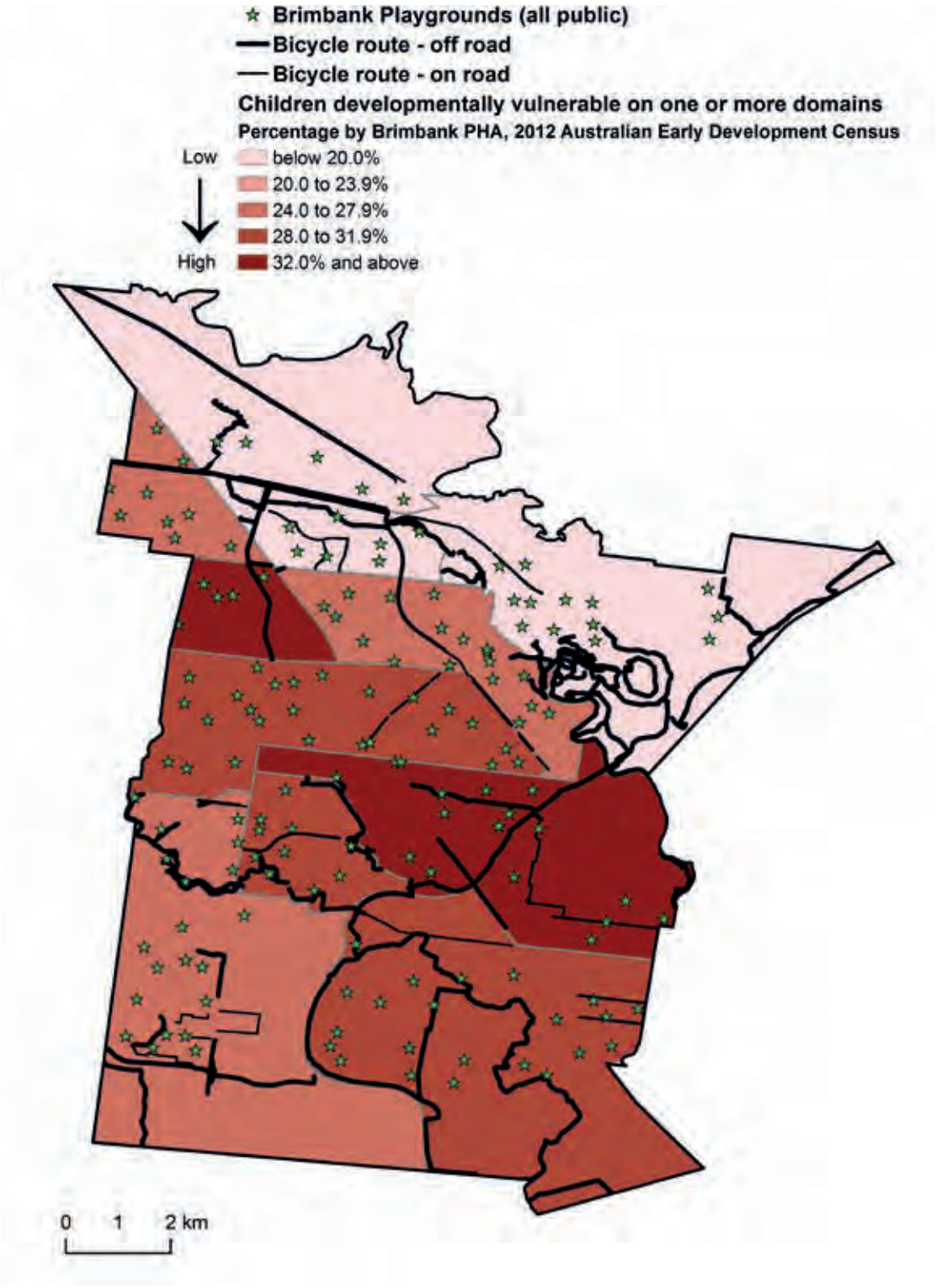
Map 4.6.10 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for packaged liquor licenses



Map 4.6.11 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for roads, accident black spots, and playgrounds



Map 4.6.12 Children developmentally vulnerable on one or more domains, by Brimbank PHA

Overlay for bike paths and playgrounds

4.6.6 Discussion

The distribution of developmentally vulnerable children tells a familiar story, reiterating the link between socio-economic disadvantage and health and education outcomes (see Map 4.6.1). But there are also some less obvious patterns. In Brimbank, and in larger investigations of the AEDC data, socio-economic disadvantage accounts for much, but not all, of the geographic variation in health and education outcomes. This suggests the need to investigate other localised factors that may be influencing children's development before they begin school (Brinkman et al. 2012, Cappie-Wood 2013, Villanueva et al. 2015a).

The AEDC is a large dataset, containing information from all Australian states. It is a gauge of **school readiness**. High rates of children who are developmentally vulnerable on one or more domains indicate that schools in the area will face greater challenges. They will receive high proportions of children who are less ready – whether physically, socially or linguistically – to benefit from schooling than others.

Research using the full AEDC dataset has found significant correlations between school readiness and socio-economic disadvantage. It has also detected that the effect of socio-economic disadvantage on childhood development is greater for male children and in some states. Brinkman et al. (2012) concluded that:

> *[I]t is both heartening and disturbing to discover such differences across jurisdictions. It is heartening because it highlights that child health and development may be improved by factors other than socio-economic and demographic factors.*
> *(Brinkman et al. 2012)*

Consistent with this wider research, and with the other two Brimbank Collaboration foundation reports, Brimbank PHAs show positive correlations between rates of developmentally vulnerable children and rates of socio-economic disadvantage, but with some variations. Particular components of the IRSD are more strongly correlated: rental stress, mortgage stress, and recent migrants from NES countries. The Delahey PHA, with a medium level of socio-economic disadvantage relative to the rest of Brimbank, has the highest rate of developmentally vulnerable children in the municipality.

Brimbank PHAs with high rates of developmentally vulnerable children have a relative lack of many types of physical and social infrastructure. This long list includes conservation zones, parkland, trees, fitness businesses, bike paths, licensed restaurants and cafes, take-away food stores, indoor play centres, drinking fountains and public toilets.

These negative correlations are strongly influenced by the Delahey PHA, which has the highest rate of developmentally vulnerable children and is primarily a residential area, but lacks parkland and has no commercial zones. This factor exerts a potentially misleading influence on correlation results, especially for such a small dataset.

The lack of neighbourhood variation and high rate of developmentally vulnerable children in Delahey are consistent with research that suggests a mix of walkable neighbourhood destinations has a positive impact on childhood development (Christian et al. 2015).

Nevertheless, most government and not-for-profit facilities and services for children are distributed evenly throughout Brimbank, so are not significantly correlated with rates of developmentally vulnerable children. The list of non-correlated features at Brimbank PHA level includes:

- libraries;
- aquatic centres;
- childcare centres;
- community centres;
- neighbourhood houses;
- playgrounds (with the exception of playgrounds in large flagship parks);
- playgroups;
- school crossings;
- state primary schools;
- sports fields; and
- walking school bus stops.

This suggests that most government and not-for-profit destinations for children in Brimbank are widely accessible. Maps 4.6.3 to 4.6.7 confirm this conclusion.

However, a look at two commercially run activities for children – private swim schools and indoor play centres – presents a different picture (see Maps 4.6.8 and 4.6.9). They have an uneven distribution across Brimbank, and are absent from PHAs

with higher rates of developmentally vulnerable children. This emphasises the importance of maintaining government and not-for-profit facilities and services for children, as commercial providers tend to overlook vulnerable areas. The pattern is amplified by the discouraging and very strong positive association with proximity to packaged liquor licenses (Map 4.6.10).

It is argued that GIS has been greatly under-utilised as a tool for exploring child development (Villanueva et al. 2015b). Christian et al. (2015) reviewed the literature on the components of local environments that impact upon child development. The results are summarised in Figure 4.6.2 below.

Although the information collected for this report was not specifically aligned with the framework shown in Figure 4.6.2, there is considerable overlap. Some of the suggested neighbourhood factors from this diagram are discussed below.

Whilst access to bulk billing GPs was strongly associated with higher rates of childhood vulnerability, greater access to **late-opening GP surgeries** was only moderately associated with higher rates of children who were developmentally vulnerable in one domain or more.

However, when exploring the specific domain of children developmentally **on track in language and cognition**, fewer late-opening GPs in proximity to residences (but not per person) was found to be strongly associated with higher rates of children on track.

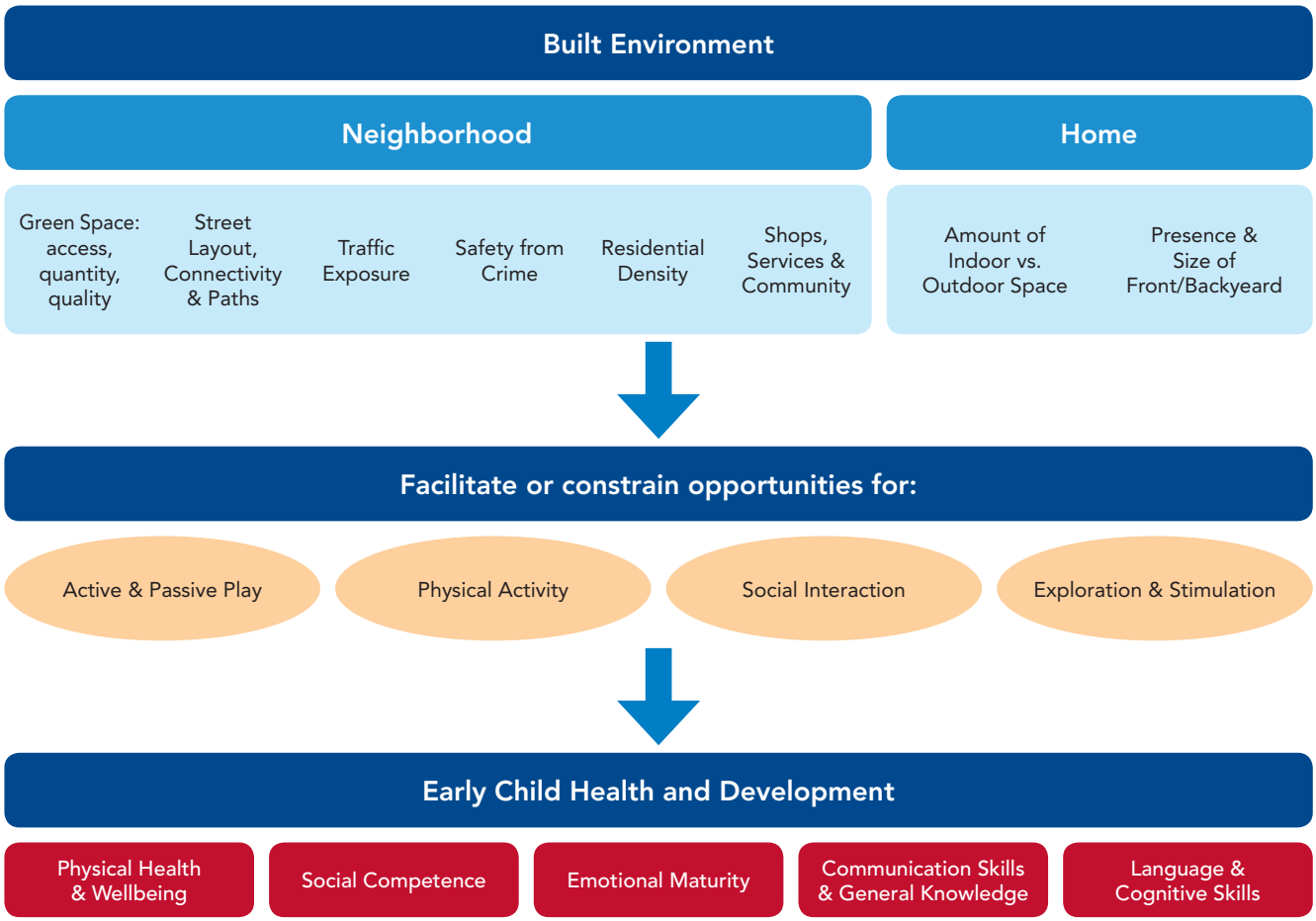


Figure 4.6.2 A model of how the neighbourhood physical environment facilitates or constrains healthy child development

From "The influence of the neighbourhood physical environment on early child health and development: A review and call for research" (Christian et al. 2015)

Green Space

Brimbank PHAs with higher rates of children developmentally vulnerable on one or more domains have less parkland and fewer trees than other PHAs. However, there is no association with proximity to public playgrounds, which are distributed across all residential areas in Brimbank. Larger flagship playgrounds are an exception, and are less prevalent in areas of low socio-economic status and poorer health outcomes.

The implementation of the *Brimbank Urban Forest Strategy 2016-2036* has the potential to increase children's use of public space and services by protecting streets and parks from harsh sun.

Street Layout

Brimbank PHAs with higher rates of developmentally vulnerable children show no significant correlation with footpaths (but they have significantly less access to **bike paths**). However, the presence of footpaths is a crude measure of 'walkability'; a true analysis requires algorithms for density and connectivity, which are outside the scope of this report.

Accordingly, the Australian Urban Research Infrastructure Network's (2014) (AURIN) walkability assessment tools[32] have great potential for use in future Brimbank research. The tools are already available for use in two LGAs near Brimbank.

Traffic Exposure

It is methodologically difficult to incorporate traffic exposure in PHAs in a correlation table. However, the number and ubiquity of high-volume arterial roads, as well as traffic accident black spots and space for car transport generally throughout Brimbank, should be borne in mind. Like take-away food outlets, they are not obviously correlated with health measures within Brimbank because of their ubiquity. This is emphasised in Maps 4.7.11 and 4.7.12, which show the space allotted to cars, playgrounds and bikes.

Literature indicates that 'stranger danger' and road safety concerns are primary motivations for parents restricting children's outdoor activity (Carver et al. 2008). Hence, spaces like libraries, leisure and aquatic centres, and playgrounds, which are maintained by Brimbank City Council (as part of the Council's remit for the community's community health and wellbeing), are even more important when much outdoor space is effectively off-limits for children.

Safety from crime

As discussed earlier in this report, Victorian crime data are not available at finer detail than LGA level. Brimbank has lower rates of crimes against the person but higher rates of property crime than other municipalities in Melbourne.

The gendered aspects of crime and perceptions of safety are also relevant for children's access to physical and social infrastructure: violence, actual or perceived by women, may be a factor in restricting children's access to public space (Giles-Corti et al. 2013).

Shops, services, and community

This topic is mentioned throughout this report. The available data suggest that government and not-for-profit providers of services for children are important in the socio-economically disadvantaged areas of Brimbank, given that commercial providers tend to be unevenly distributed, with more packaged liquor licenses and fewer fitness and play spaces in disadvantaged areas. In this respect, the relatively even access to services like libraries, maternal child health centres, and playgrounds is a much-needed asset for children in Brimbank.

32 http://docs.aurin.org.au/portal-help/analysing-your-data/walkability-tools/

Section 5: Discussion

This report presents maps and correlation tables describing the strength of relationships between specific health outcomes for residents of Brimbank and local physical and social infrastructure assets and deficits. Not all features of Brimbank are included, but many are combined into the maps and correlation tables.

The results should be viewed in conjunction with the other two Brimbank Collaboration foundation reports and also with reference to Appendix A, which details all correlations (as some datasets that contain few significant correlations may not be listed in the body of the text).

The maps and correlations do not provide easy answers to the problems affecting health and wellbeing in Brimbank, but highlight particular patterns that inform thinking about solutions.

Several wellbeing indicators have very similar geographical distributions and strong correlations with the IRSD: estimated rates of self-assessed fair or poor health, female obesity, diabetes, psychological distress and childhood developmental vulnerability (see summary Maps 5.1.1). These consistent patterns in the Sunshine North, St Albans and Kings Park corridor suggest that socio-economic disadvantage is a very strong determinant of health inequity and warrants further enquiry and policy attention.

These indicators also correlate with the presence or absence of particular commercial services: more bottle shops, fewer play centres and gyms. However, services provided by Brimbank City Council, the Victorian government, and not-for-profit organisations (such as the flexible learning programs identified in Map 4.4.5 and incorporated community groups in Map 4.1.6) are more prevalent in these areas.

Other indicators present more of a puzzle, into which this report offers some insights. For example, hospitalisation rates for ACSCs are not predictable from socio-economic disadvantage. Late-opening GP services are concentrated in Deer Park and Cairnlea, where there are lower rates of hospitalisations for ACSCs in children, but there is a relatively large number of GPs in St Albans, where there are higher rates of hospitalisations for children. It seems that late-opening GP services, rather than all GPs, have the greatest impact on hospitalisation rates for ACSCs.

One of the most useful and illuminating ways of using GIS is overlaying the concentration and distribution of features (such as bicycle paths, high-volume road traffic, playgrounds or toy libraries) over the geographical distribution of the rates of a risk factor, such as developmentally vulnerable children. These information overlays are critical in:

- understanding how health outcomes, assets and environment interact;
- identifying questions that guide further exploration of the determinants of health outcomes; and
- revealing what proximity of such as schools to infrastructure (such as packaged liquor licenses, the distribution of which has a positive correlation with high rates of developmentally vulnerable children) means for future urban planning and policy.

Social and physical infrastructure are both assets to build upon and a focus for improved policy and practice designed to increase individual and population capacity for better health and wellbeing.

5.1 Assets to work with

- Brimbank has an even distribution of fresh food outlets and major supermarkets.
- The Brimbank City Council facilities of relevance for health and wellbeing – libraries, kindergartens, maternal and child health centres, leisure centres, playgrounds and sports fields – are evenly distributed.
- Primary health care providers are spread throughout the community, with a relatively large number of GPs in the most socio-economically disadvantaged areas.

5.2 Gaps and limitations

- PHAs are large and diverse geographical areas, but are the smallest unit at which health data can be analysed. This means that correlation analysis within Brimbank is likely to aggregate some population groups with quite different characteristics, and therefore miss potentially important associations.

  For example, Derrimut and Deer Park comprise one PHA but have different population and geographical characteristics and show distinctly different rates of hospitalisations for ACSCs.
- Not all the datasets used in this report exist for other municipalities in Melbourne, so assessment of how Brimbank compares is not always possible. For example, the Brimbank 2011 food survey is excellent, but direct equivalents do not exist in other LGAs. Therefore, analysis of food accessibility is limited to Brimbank.
- Some datasets do not allow comparisons between different parts of Brimbank. Most notably, statistics on crime and perceptions of safety are only available at LGA level.
- The datasets from the other two Brimbank Collaboration foundation reports (2014) were based on 2011 Census data. Data collected specifically for this project, such as for medical practitioners, supermarkets and play centres, reflect more recent distributions.

5.3 Areas to focus on

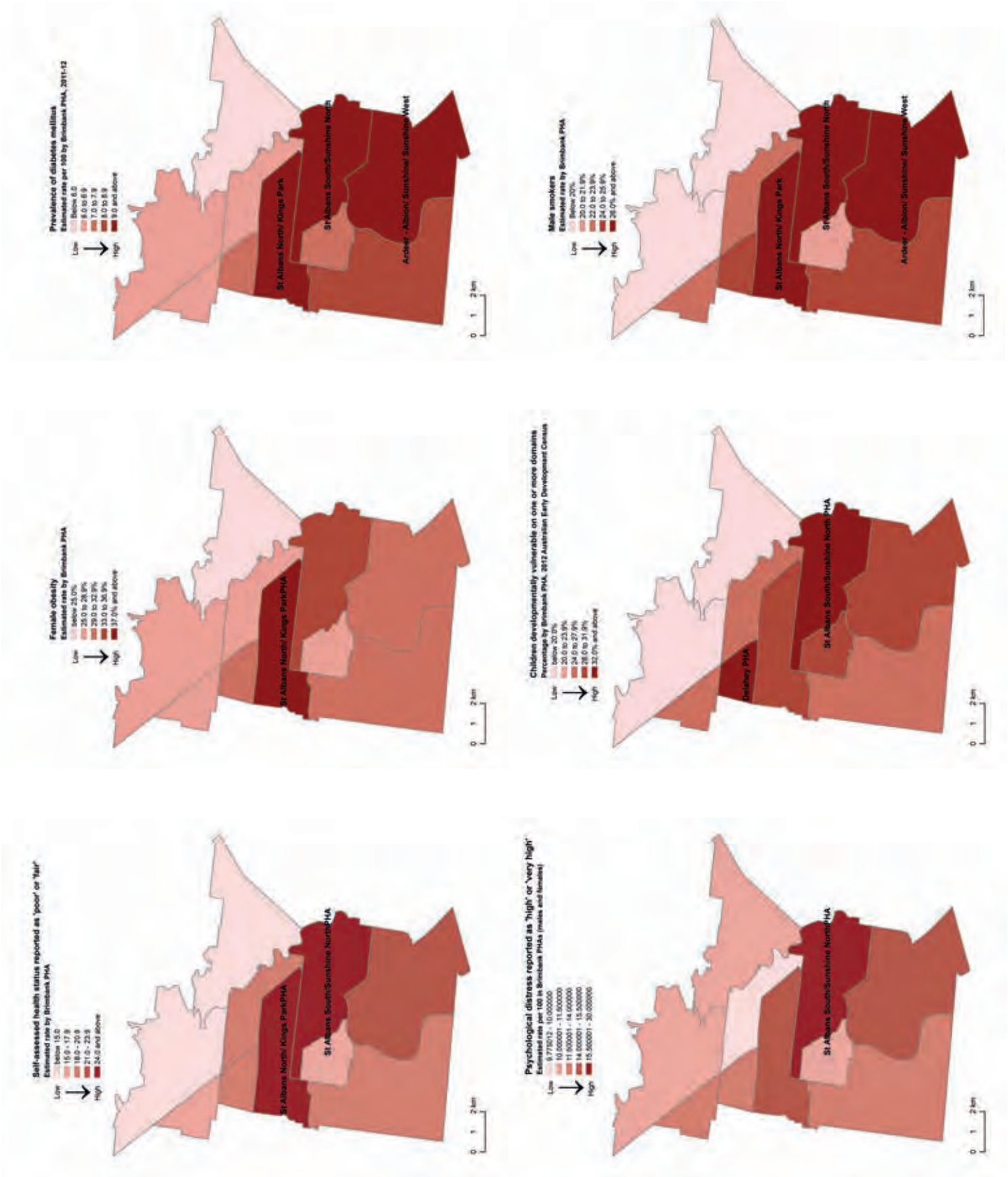
- Fresh food outlets are present throughout the community but are not as prevalent as take-away food outlets.
- Major supermarkets are under-represented in St Albans, but the suburb has many premises selling fruit (usually cultural supermarkets).
- While take-away food outlets are ubiquitous, other commercial services – gyms (especially women's gyms), swim schools and children's indoor play centres – are significantly less prevalent in the most disadvantaged areas, while bottle shops and bulk billing GPs are more prevalent.
- St Albans and Kings Park have the most deficits among Brimbank PHAs. These areas have higher rates of negative health indicators and socio-economic disadvantage and:
  - fewer trees, parks, shelter shades, bike paths, etc., and
  - higher concentrations of packaged liquor licenses, poker machine licenses and take-away food stores.
- High-needs areas tend to have many community groups, many social services and many kindergartens, all of which are community strengths from which to develop capacity for greater wellbeing.

5.4 Concluding comments

Sections of the foundation reports will be updated as new collections of Australian Census and health data are made available. The correlations with infrastructure identified in this report should and will continue to guide the collection of updated infrastructure data in parallel.

This report demonstrates what can be achieved with health data and spatial data. The report does not present comprehensive studies of any of the features in Brimbank or of the health and wellbeing indicators.

The results should be regarded as a gauge of health and wellbeing assets in Brimbank, and as a guide for future enquiry and policy development.



Maps 5.1.1 Summary of patterns of socio-economic disadvantage by Brimbank PHA correlated with selected health indicators or outcomes

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Glossary

ABS	Australian Bureau of Statistics
ACSC	Ambulatory care-sensitive condition
AEDC	Australian Early Development Census
ASGS	Australian Statistical Geography Standard
AHPC	Australian Health Policy Collaboration
CALD	Culturally and linguistically diverse
EPC	Enhanced Primary Care (superseded by Chronic Disease Management services in 2005)
GIS	Geographic Information Systems
GP	General practitioner
IRSD	Index of Relative Social Disadvantage
LGA	Local government area
Indicator	Summary measures of chosen events derived from data collections that record all cases or a representative sample of the events in a population.
NES	Non-English-speaking
PHA	Population Health Area
Risk factor	A condition that adversely influences health, wellbeing and development outcomes. In this context, risk factor is used as a preferred term to *social determinants* of health. Risk factors are related to social, economic, and environmental factors.
SA1s	Statistical Area Level 1
SAH	Self-assessed health
SLA	Statistical Local Area
SEIFA	Socio Economic Indices For Area
sqm	square metres

Appendix A

Method

The basic concept of the methodology is that two main groups of data were collected, combined based on location, then presented as correlation results and combined maps (see Figure 3.1).

The two main groups of data were:

1. *Brimbank Atlas* indicators of health and wellbeing

   The set of indicators already collected by PHIDU (Public Health Information Development Unit), included in the *Brimbank Atlas of Health and Education*, and downloadable from the PHIDU website.[33] These data can be downloaded as spreadsheets, enabling linkage into GIS (as for this report). Alternatively, maps and spatial statistics can be generated live on the PHIDU website.

2. Additional spatial datasets of different Brimbank features

   Additional spatial datasets from a variety of sources, which were not specifically tagged as health or wellbeing data but which could be of relevance for describing assets and deficits in Brimbank. These datasets were collected incrementally from different sources and combined with the PHIDU data.

The health and wellbeing indicators were already available, while the second group needed to be collected. The second group of data includes a variety of different features not specifically related to health and wellbeing, but which could help to describe local community assets or deficits within Brimbank.

Initially, AHPC staff drafted a list for potential collection, based on expert opinion of features that might constitute assets or deficits within Brimbank. Not all possible datasets of interest were able to be obtained in the time available. Over 100 datasets were collected, relating to food outlets, kindergartens, sports fields, public transport, accident black spots and commercial fitness providers. Some datasets could be classified as assets, others as deficits, and others as neutral.

A list of dataset names is included at this end of this section, and details of the datasets are listed on page 177.

In brief, the main sources for additional spatial datasets of different Brimbank features were:

1. Brimbank City Council

   Brimbank City Council provided data to the AHPC in September 2015.

2. AURIN portal

   The AURIN, a site for sharing spatial data for use in research.

   www.aurin.org.au

3. VicMap

   The Victorian state government spatial data provider.

   https://services.land.vic.gov.au/landchannel/content/productcatalogue

4. Health Engine

   A commercial search engine for health care providers in Australia.

   www.healthengine.com.au

5. Core List Australia

   A commercial provider of business contact lists, including for doctors, dentists and pharmacies.

   www.corelist.com.au

6. The National Health Services Directory, accessed via the Arthritis Victoria website

   A list of health service providers mediated by the Federal Government.

   www.arthritisvic.org.au

   www.nhsd.com.au

Some datasets were already formatted for use in GIS. Others needed to be coded to locations within Brimbank, most commonly to residential addresses.

To generate correlation results, all data needed to

33 PHIDU website: http://phidu.torrens.edu.au/

be allocated to PHAs, the smallest geographical areas at which the health and wellbeing indicators are reported. The aim was for health and wellbeing data to sit side-by-side with indicators of the prevalences of different features (eg. rates of smoking alongside the number of take-away food outlets in each respective Brimbank PHA). The combined table was entered into a statistics program to generate correlation results (see below: 'How to read correlation outputs').

Because the number of PHAs in Brimbank is very small (10), it is very important to remember that the correlation results generated in this way are only approximate. They should be interpreted alongside the maps and the written discussion. More information on how to interpret the correlation results is provided at the end of this section.

Combined maps were produced using the health and wellbeing variables as the base and the additional datasets as overlays. However, it was not possible to map every dataset with every health and wellbeing indicator (there are over 2,000 possible combinations).

Maps can help visually highlight patterns, or in some cases, the absence of patterns. Correlation results can numerically highlight patterns or their absence. Together, the correlation results and maps help to inform thinking on the health and wellbeing indicators from *The Brimbank Atlas of Health and Education*, particularly on the questions of:

- Are there concentrations of assets or deficits in particular areas?
- Are there possible connections between datasets?

Spatial metadata accompanying Brimbank Spatial Map of Physical and Social Infrastructure and other supporting technical information will be lodged on the AHPC website.

Relevant concepts in spatial data

This subsection describes some relevant concepts in spatial data which can help understanding the origins of the data.

Different geographical areas

The majority of population and health data are made available as numerical data attached to geographical areas (also referred to as 'polygons'). These geographical areas – LGAs, SA1s, Localities/ Suburbs, SLAs and PHAs – vary in size, as demonstrated overleaf in Figure 3.2.

Some geographical areas are a familiar part of everyday life: states, countries, postcodes, electoral divisions. Others are used mainly for research and policy purposes.

In Australia, PHAs are the smallest area for which health data are available. PHAs are related to other (more familiar) geographical areas, as described below.

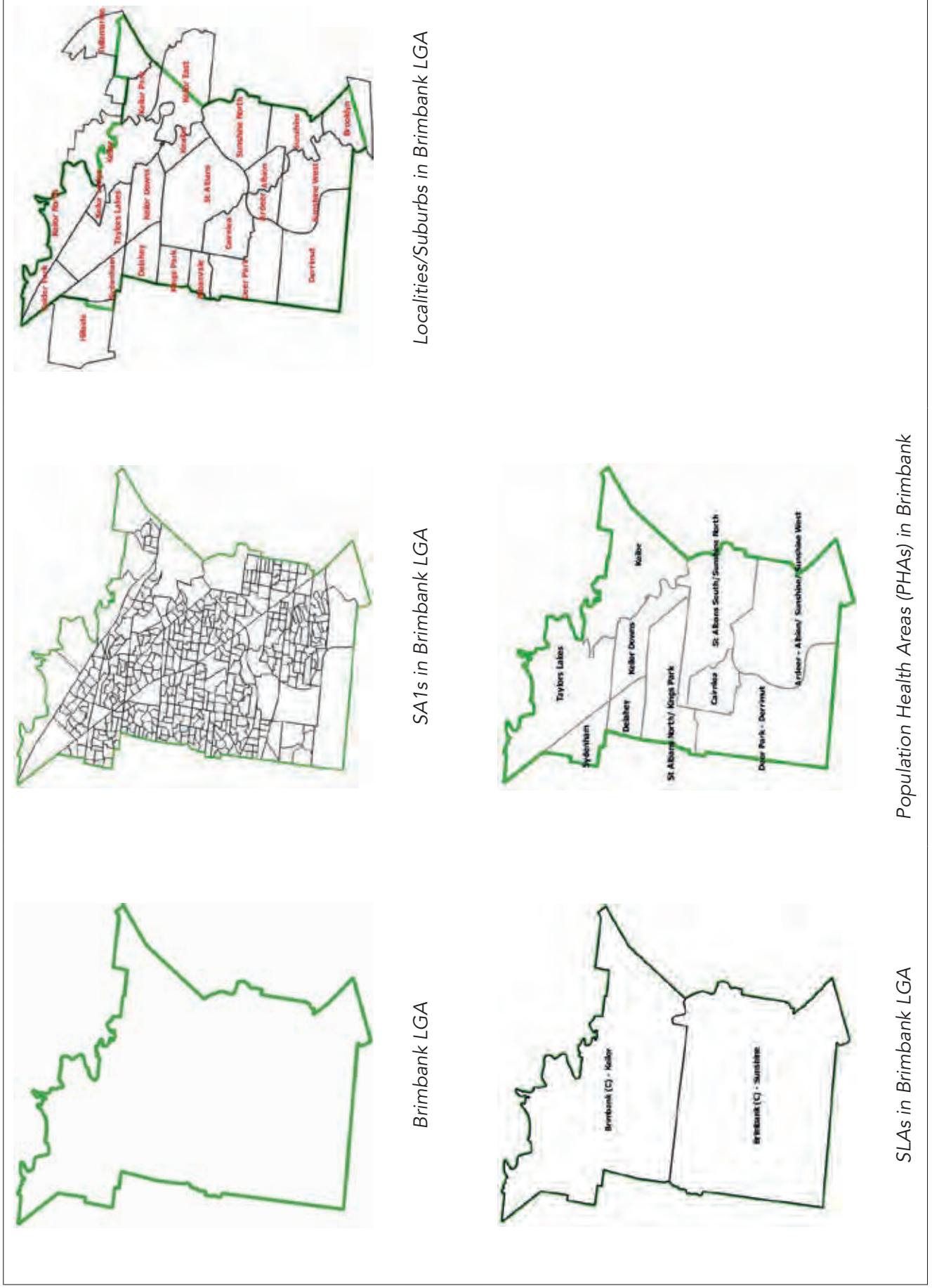

Figure 3.2 Different geographical areas within Brimbank

The geographical areas are described in descending order of size.

Local Government Areas

There are 79 LGAs in Victoria (including Brimbank). The large sizes of LGAs can obscure internal variation, such as wide differences in income levels or age groups.

Some statistics, such as crime rates, are only available at LGA level. This is usually because of confidentiality concerns, or because the number of overall incidents is not high enough to yield sensible comparisons for smaller areas.

Statistical Local Areas

The SLA is a popular spatial unit for communicating population and health data in research and policy publications. SLAs were defined under the older Australian Standard Geographical Classification (ASGC), now replaced by the Australian Statistical Geography Standard (ASGS) geographical classifications.[34]

There are only two SLAs in Brimbank: *Brimbank – Keilor* and *Brimbank – Sunshine*.

SLAs can report broad differences within a LGA, but not much more detail.

In the *Brimbank Atlas of Health and Education*, correlation results were presented for health and wellbeing data by SLA in Melbourne.

Suburbs / Localities

'Locality' effectively means 'suburb'. Locality is a term used in Victorian spatial data, which also includes country towns. In this report, 'suburb' is used for readability.

There are 25 suburbs wholly or partly within Brimbank. Suburbs are well-recognised areas used in addresses and other descriptions, and often do not need to be described in detail to readers.

Population Health Areas

PHAs are a combination of suburbs and SLAs. PHAs are specifically used for Australian health data, in order to gain as much detail as possible as they are small enough to convey internal variation within LGAs. They can be described with recognisable suburb names (eg. the Keilor PHA).

As noted earlier, Brimbank has 10 PHAs. These PHAs are used for maps and summary tables in the *Brimbank Atlas of Health and Education*, and are the basis of correlation results and base maps in this report.

Statistical Areas Level 1

SA1s are very small polygons defined by the Australian Bureau of Statistics for the distribution of Australian Census data under the ASGS.

There are 643 SA1s within Brimbank. SA1s are an excellent resource for making detailed maps of Census data, such as the fine-grained maps of income and education in Brimbank on the .id Social Atlas for Brimbank.[35]

However, **most health data are not available for SA1s**. There are confidentiality concerns as well as, for some health indicators, low prevalence rates which can make results unreliable. This means that health data can rarely be seen at the same level of geographic detail as Census data such as age and income profiles.

Modifiable Aerial Unit Problem

The Modifiable Aerial Unit Problem refers to the fact that different correlation results can be produced from the same spatial data, depending on the scale and the size of polygon used. This is because relationships between datasets can be obscured or exaggerated by different ways of grouping the data.

In this report, correlations are always referred to as *'at Brimbank PHA level'*. It is possible that different results could be returned for maps at a wider scale: at SLA level in Victoria or Melbourne, for example, or LGA level in Australia.

34 The ASGS became the ABS's geographical framework from July 2011. See: www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Standard+Geographical+Classification+(ASGC) and www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Statistical+Geography+Standard+(ASGS)

35 id Social Atlas for Brimbank: http://atlas.id.com.au/brimbank#

However, the good news and the bad news is that the Modifiable Aerial Unit Problem can never be removed, just ignored – even when dealing with ostensibly non-spatial data. For example, reporting income per capita at a national level obscures variation within different cities and suburbs.

The most likely ramification of the Modifiable Aerial Unit Problem in this report is that some features may be concentrated in Brimbank as a whole, but show no internal variation within Brimbank (and thus return few significant correlation results at PHA level). Conversely, features which vary in distribution within Brimbank are more likely to return statistically significant results. For some features, their ubiquity within Brimbank as a whole is a more relevant point of discussion, and hence a comparison to other municipalities would be important for further research. These cases are highlighted where relevant.

Combining features for correlation

This subsection describes how data was input for correlation in this project. Understanding this can help with interpretation of correlation results.

Blending map features for producing correlation results in this report required extra processing. All data needed to relate back to PHAs, regardless of how precisely they could be represented on maps. Numerical measures were needed to represent varying levels of prevalence of particular features in the different PHAs.

For this report, a methodological approach was taken that was similar to that in a study of diabetes and food stores in the US (Sharkey et al. 2009). This used both *coverage* and *proximity* as measures of access to features.

Coverage measures how many of a particular feature type are found in an area. For this report, the features in the different datasets were grouped by PHA and then averaged by population. This generated figures in the correlation table for concepts such as *bus stops – per person*, and *bulk billing doctors – per person*. All these measures are almost impossible to interpret in and of themselves; measuring the variation in the figures *between* different Brimbank PHAs was the primary purpose.

Proximity measures how close (on average) residents are to different features. For this report, this measure required much more time to process than coverage, hence it was applied to a smaller list of features. These are shown in the list of datasets on the next page.

Measuring proximity for this report involved measuring the distance from each residential address in Brimbank to the closest feature of interest (eg. the closest train station, or the closest take-away food outlet). The distances from each residence were then averaged across the PHAs. This process generated figures in the correlation table for concepts such as *libraries – proximity to residences*. These figures are slightly easier to interpret on their own, but again, the primary purpose was to measure *variation between PHAs.*

List of datasets

The following is a list of the datasets included in analysis. Datasets used to calculate proximity from residential addresses are in bold red.

Accident Black Spots
Activity Centres
Address Zoned Residential
Aged Care Facilities
Aquatic Centres
Arterial Road Average Daily Traffic Volume
Arts And Culture Facilities
Art Works
Bicycle Route – Off Road
Bicycle Route – On Road
Bulk Billing GPs
Bus Stops
Bus Routes with Sunday Service
Cafes
Caravan Parks
Cats
Childcare Centres
Cinema
Community Centres
Community Groups – "Friends Of"
Community Groups – Summary By Locality
Conservation Zones
Contours
Crown And Special Land
Dangerous Dogs
Doctors
Dog Off Leash Areas
Dogs
Drinking Fountains
Family Day Care
Fitness Businesses
Flexible Learning Facilities
Food Survey – Bakers Butchers and Delis
Food Survey – Cultural
Supermarkets
Food Survey – Mixed Business
Food Survey – Selling Fruit
Food Survey – Selling Vegetables
Food Survey – Supermarkets
Food Survey – Take Away (All)
Food Survey – Take Away (Chain)
Food Survey – Take Away (Cultural)
Food Survey – Take Away (Independent)
Footpaths
GPs – Late Opening – Sourced From Arthritis Victoria
GPs – Sourced From Arthritis Victoria
Gym Businesses (All)
Halls
Hotels
Indoor Play Centres
Kindergartens And Preschools
Libraries
Licensed Clubs
Licensed Restaurants And Cafes
Major Supermarkets
Maternal Child Health Centres
Neighbourhood Houses
Out Of School Hours Childcare
Packaged Liquor Licences
Parkland – Combined
Plan Zone – Business
Plan Zone – Industrial
Plan Zone – Residential1
Playgrounds – Flagship
Playgrounds – All Public
Playgroups
Poker Machine Venues
Power Facilities
Private Swimming Schools
Property
Public Toilets
School Crossings
Schools – Primary
Schools – Secondary
Schools – State Primary
Schools – State Secondary
Scouts And Guides Halls
Senior Citizens Centres
Shelter Shade
Skate Parks
Smart Bus Routes
Sport Buildings
Sport Polygons – All
Sport Polygons – Athletics
Sport Polygons – Baseball
Sport Polygons – Basketball
Sport Polygons – Bowling Green
Sport Polygons – Croquet Green
Sport Polygons – Golf Course
Sport Polygons – Hockey
Sport Polygons – Motor Track
Sport Polygons – Sports Complex
Sport Polygons – Sports Ground
Sports Facilities – Tennis Court
Streams And Rivers
Sunshine Hospital
TAB Agencies
TABs (All)
Toy Libraries
Train Stations – Electrified
Trees – Open Space
Trees – Public – Both Types
Trees – Street
Victoria University Campuses
Walking School Bus Routes
Walking School Bus Stops
Women's Gym Businesses

How to read correlation outputs

A correlation coefficient is a numerical expression of the strength of association between two continuous variables. It represents the probability of two sets of numbers varying together to the same extent if they were simply random.

A correlation coefficient can vary between -1 and +1. Correlation coefficients closer to +1 or to -1 are more significant. In this report correlation coefficients of greater than 0.71 are flagged as significant. In this report, the non-significant correlation coefficients are excluded from the summary tables.

Significant correlations can be positive or negative. In this context, positive and negative do not mean 'beneficial' and 'detrimental', but indicate the direction of association.

A significant correlation coefficient with a minus sign (i.e. closer to -1) indicates a negative correlation, often referred to as an *inverse correlation*. That is, two variables fluctuate at a similar rate, but in opposite directions. For example, the mileage on a second-hand car and sale price tend to be inversely correlated. This report uses the term *inverse correlation*.

A correlation coefficient (closer to +1) indicates a positive association between two variables. That is, they vary at a similar rate, and in the same direction. For example, the time spent walking and distance travelled will be positively correlated.

A double asterisk after the correlation coefficient (**) indicates a strong correlation, of magnitude 0.75 or more. **In Section 4, strong correlations are also highlighted in bold font.**

Easier-to-read snapshots from the full correlation table are included throughout Section 4. These are formatted to be easier to read for each indicator of interest, but an understanding of correlation coefficients is still necessary.

At times, the lack of any significant correlation between particular variables is surprising, and is referred to during discussion.

Because there are only 10 PHAs within Brimbank all correlations – significant or otherwise – should be interpreted very carefully alongside maps and relevant literature.

The correlation tables are also put into written form, for example:

"The PHAs in Brimbank with higher estimated rates of children developmentally on track under the physical health and wellbeing domain also had:

- greater proximity to indoor play centres;
- more chain takeaway food outlets per person;
- more parkland;
- lower proportions of dwellings in rental stress and dwellings in mortgage stress;
- lower proportions of children developmentally vulnerable on one or more domains; and
- greater distances from state primary schools and from packaged liquor licenses."

The correlation results also mean that the reverse statements are true, as follows.

"The PHAs in Brimbank with lower estimated rates of children developmentally on track under the physical health and wellbeing domain also had:

- less proximity to indoor play centres;
- fewer chain take away food outlets per person;
- less parkland;
- higher proportions of dwellings in rental stress and dwellings in mortgage stress;
- higher proportions of children developmentally vulnerable on one or more domains; and
- greater distances from state primary schools and from packaged liquor licenses."

Section 4 also includes written descriptions of correlation results in the style of the first summary. The second, 'mirrored' part of the description can be inferred from the formatted tables.

Regardless, from these results, the reader should *not* conclude that play centres directly help children to be developmentally on track, or that state primary schools do the opposite. But together the correlations give a picture of the sorts of areas in Brimbank where children are more likely to be developmentally on track. **They indicate correlation, but not causality. They can start a conversation about why these features go together, based on numerical evidence.**

Few features are likely to be truly independent. The lack of rental stress and mortgage stress can indicate relative economic advantage in these areas. The fact that these areas also have more

parkland, more play centres, and fewer bottle shops, is likely to be an artefact of this advantage.

However, careful interpretation is always required. It can be particularly helpful to compare correlation results for different indicators, and to consider the results in combination with the literature referred to in each discussion.

The correlation matrix (see Appendix B) enables the reader to quickly gauge the 'heat map' of what are the most important associations of physical and social infrastructure with poor health and education outcomes and what might be the 'clusters of interest'. The matrix covers a sample of contextual indicators, demographics, and infrastructure which also relate to the key domains influencing health and wellbeing represented in the Health Map (Barton) Figure 1.3. The very strong correlation coefficients (0.84 - 1.0) can be either positive (dark red) or inverse (dark blue), neither of which indicate a 'good or bad thing', just the degree to which presence or absence of a feature is associated with the health and wellbeing outcome.

Some features are so pervasive in Brimbank that there is not sufficient variation to show any correlation between the infrastructure and health and development outcomes. However, some are included in the matrix to show their role enabling healthy choices and their importance for planning and service development.

Appendix B: Correlation matrix of priority indicators

Correlations matrix of the indicator data at the Population Health Area level within Brimbank Health and Wellbeing Indicators

		Rates of Ambulatory care sensitive conditions for ages 0 to 14	Rates of Ambulatory care sensitive conditions for ages 15 and over	Estimated rates of Self Assessed Poor or Fair Health	Estimated rates of Diabetes #	Estimated rates of Circulatory disease #	Estimated rates of Psychological distress #	Estimated rates of Male smokers #	Estimated rates of Female smokers #	Estimated rates of Male obesity #	Estimated rates of Female obesity #	Estimated rates of Harmful alcohol use #	People aged under 65 Living with a disability - percent	Rates of Early school leavers	Children developmentally vulnerable on one or more domains	Children developmentally on track - physical health	Children developmentally on track - language and cognitive skills
Contextual indicators	Socioeconomic Disadvantage	-0.380	-0.535	.982**	.952**	0.418	.908**	.972**	0.445	0.558	.859**	.903**	.874**	.928**	.808**	-0.462	-.704*
	Percentage of Jobless families	-0.343	-0.585	.984**	.958**	0.458	.881**	.959**	0.465	0.561	.856**	.906**	.896**	.927**	.739*	-0.342	-.639*
	Dwellings in Mortgage stress	-0.529	-0.297	.914**	.872**	0.301	.787**	.836**	0.159	0.543	.808**	.716*	.770**	.755*	.874**	-.656*	-.770**
	Dwellings in Rental stress	-0.447	-0.164	.726*	.639*	0.216	.679*	.707*	0.199	0.369	0.597	0.558	0.582	.652*	.892**	-.759*	-.873**
	Single parent families - Percentage	-0.248	-0.581	.957**	.908**	0.498	.837**	.948**	0.578	.670*	.807**	.930**	.899**	.961**	.718*	-0.334	-.637*
	Born in NES country - Percentage	-0.625	-0.398	.895**	.849**	0.207	.775**	.829**	0.120	0.424	.722*	.701*	.724*	.725*	.872**	-0.598	-.712*
	Voluntary work - people engaged in - percent	.632*	0.104	-.774**	-.680*	-0.008	-0.590	-.715*	-0.145	-0.500	-.706*	-0.583	-.688*	-0.623	-.799**	0.49	.856**
	Dwellings with no motor vehicle	-0.186	-.715*	.826**	.867**	0.505	.911**	.890**	0.541	0.321	.735*	.889**	.728*	.850**	0.532	-0.199	-0.366
Demographics	Percentage Learning or earning aged 15 to 19	0.566	0.254	-.683*	-0.575	-0.086	-.665*	-.785**	-.675*	-0.548	-.661*	-.843**	-.683*	-.707*	-0.558	0.109	.686*
	Proportion of population Aged 0 to 14 years	-.863**	0.297	0.048	-0.027	-0.425	0.072	0.039	-0.295	-0.056	0.024	-0.002	-0.086	-0.171	0.349	-0.369	-0.324
	Proportion of population Aged 15 to 24 years	0.416	.682*	-0.415	-0.450	-0.498	-0.513	-0.461	-0.311	-0.310	-0.211	-0.584	-0.269	-0.474	-0.163	-0.011	0.095
	Proportion of population Aged 25 to 44 years	-.916**	-0.149	0.352	0.288	-0.269	0.461		0.145	0.030	0.272	0.468	0.215	0.226	0.45	-0.2	-0.368
	Proportion of population Aged 45 to 64 years	.841**	0.382	-0.444	-0.420	-0.014	-.643*	-0.563	-0.245	-0.076	-0.309	-0.608	-0.251	-0.385	-0.49	0.297	0.361
	Proportion of population Aged 65 and over	0.614	-0.587	0.125	0.228	.728*	0.198	0.147	0.337	0.179	0.034	0.230	0.132	0.358	-0.209	0.182	0.241
Physical and Social Infrastructure	Proportion of population Aged under 5	-.874**	-0.149	0.326	0.255	-0.176	0.409	0.417	0.192	0.188	0.233	0.470	0.202	0.258	0.401	-0.184	-0.408
	Accident black spots - per person	0.288	-0.466	-0.345	-0.182	0.590	-0.044	-0.278	-0.055	-0.271	-0.422	-0.172	-0.460	-0.131	-0.523	0.265	0.452
	Accident black spots - proximity to residences	-0.403	-.662*	0.555	.643*	.708*	0.532	0.431	-0.129	0.333	0.323	0.424	0.319	0.455	0.31	-0.29	-0.166
	Residential density [ratio of population to addresses]	0.208	-.643*	0.467	0.478	0.589	0.592	0.596	.760*	0.312	0.376	.696*	0.475	.695*	0.18	0.077	-0.178
	Aquatic centres - per person	0.120	-0.165	0.042	-0.095	-0.260	-0.210	0.078	0.408	0.257	-0.124	0.136	0.198	0.187	-0.04	0.414	-0.037
	Aquatic centres - proximity to residences	-0.004	-0.598	0.515	0.469	0.388	0.302	0.483	0.415	0.448	0.317	0.467	0.533	.636*	0.197	0.239	-0.386
	Bike paths, off road - proximity to residences	-0.364	-0.108	-0.478	-0.324	-0.197	-0.023	-0.328	-0.447	-.744*	-0.458	-0.351	-.704*	-0.437	-0.294	0	0.268
	Bike track on road - total m per person	0.490	0.148	-0.607	-0.436	-0.019	-0.555	-.667*	-0.485	-0.444	-0.405	-.654*	-0.536	-0.598	-.818**	0.6	.695*
	Bus stops - per person	0.617	-0.424	-0.057	-0.002	0.354	0.060	0.056	0.491	-0.140	-0.041	0.124	0.053	0.208	-0.358	0.546	0.226
	Bus stops - proximity to residences	.747*	-0.048	0.148	0.088	0.298	0.095	0.217	.690*	0.248	0.228	0.262	0.363	0.372	-0.007	0.18	-0.101
	Childcare places - per person	-0.222	0.264	-0.268	-0.345	-0.443	-0.192	-0.227	-0.111	-0.281	-0.357	-0.147	-0.292	-0.389	0.065	-0.226	0.353
	Childcare centres - proximity to residences	-0.125	.683*	-0.361	-0.566	-.634*	-0.417	-0.307	0.092	-0.105	-0.347	-0.258	-0.239	-0.404	0.095	-0.154	-0.048
	Childcare - Out of school hours care - per person	.669*	-0.165	-0.366	-0.381	0.233	-0.408	-0.352	0.213	-0.021	-0.501	-0.222	-0.248	-0.147	-0.454	0.375	0.503
	Community centres - per person	-0.264	0.291	0.076	-0.102	-0.240	-0.130	0.016	-0.066	0.117	-0.062	-0.123	0.066	0.036	0.425	-0.357	-0.612
	Conservation zones - total sqm per person	.632*	0.087	-.697*	-0.523	0.178	-0.565	-.716*	-0.353	-0.420	-0.518	-.655*	-0.627	-0.578	-.905**	0.609	.717*
	Contour variation	.779**	0.102	-.715*	-.634*	0.078	-.714*	-.738*	-0.239	-0.238	-.697*	-.663*	-0.606	-0.525	-.777**	0.457	.703*
	Family day care - per person	-0.378	-0.465			0.299	0.363	0.450	0.094	0.208	0.443	0.405	0.530	0.419	0.249	0.205	-0.275
	Fitness businesses [all] - per person	0.490	-0.133			0.251	-0.484	-.702*	-0.390	-0.528	-.700*	-0.613	-.749*	-0.581	-.822**	0.439	.828**
	Flexible learning centres - per person	-0.359				0.294	0.576	0.472	-0.273	0.111	0.303	0.364	0.255	0.426	0.49	-0.568	-0.138

Notes: This matrix is an abridged version of the almost 150 variables explored in this report. Its purpose is to enable the reader to quickly gauge the 'heat map' of what are the most important associations of physical and social infrastructure with poor health and education outcomes and what might be the 'clusters of interest'. The matrix covers a sample of contextual indicators, demographics, and infrastructure which also relate to the key domains influencing health and wellbeing represented in the Health Map (Barton) Figure 1.3. The very strong correlation coefficients (0.84 - 1.0) can be either positive (dark red) or inverse (dark blue), neither of which indicate a 'good or bad thing', just the degree to which presence or absence of a feature is associated with the health and wellbeing outcome. Some features are so pervasive in Brimbank that there is not sufficient variation to show any correlation between the infrastructure and health and development outcomes. However, some are included in the matrix to show their role enabling healthy choices and their importance for planning and service development.

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**. Correlation is significant at the 99% confidence level
*. Correlation is significant at the 95% confidence level

R - Pearson Correlation Coefficients R^2 - Percent Variation Explained

Description	Colour Coding		From	To	From	To
Weak or no correlation	INVERSE	POSITIVE	0	0.55	0%	30%
Moderate correlation	INVERSE	POSITIVE	0.55	0.7	30%	49%
Strong correlation	INVERSE	POSITIVE	0.71	0.84	50%	70%
Very strong correlation			0.84	1	70%	100%
Not applicable			1	1	100%	100%

		Rates of Ambulatory care sensitive conditions for ages 0 to 14	Rates of Ambulatory care sensitive conditions for ages 15 and over	Estimated rates of Self Assessed Poor or Fair Health	Estimated rates of Diabetes #	Estimated rates of Circulatory disease #	Estimated rates of Psychological distress #	Estimated rates of Male smokers #	Estimated rates of Female smokers #	Estimated rates of Male obesity #	Estimated rates of Female obesity #	Estimated rates of Harmful alcohol use #	People aged under 65 Living with a disability - percent	Rates of Early school leavers	Children developmentally vulnerable on one or more domains	Children developmentally on track - physical health	Children developmentally on track - language and cognitive skills
Physical and Social Infrastructure	GPs – Bulk Billing - per person	-0.360	-0.629	0.361	0.444	0.410	0.357	0.230	-0.370	-0.077	0.036	0.174	0.092	0.184	0.297	-0.354	0.129
	GPs – Bulk Billing - proximity to residences	-0.596	-0.208	.738*	0.599	-0.123	0.557	.695*	0.206	0.342	0.514	0.614	.644*	0.548	.871**	-0.563	-0.554
	GPs – Late Opening -per person	-0.487	-0.157	-0.054	-0.055	0.175	-0.027	-0.076	-0.167	-0.010	-0.152	-0.087	-0.175	-0.036	-0.083	0.146	-0.28
	GPs – Late opening - proximity to residences	-0.530	-0.246	0.534	0.520	0.171	0.448	0.472	-0.059	0.204	0.461	0.311	0.396	0.446	0.486	-0.248	-.717*
	Gyms - per person	0.381	-0.227	-.638*	-0.434	0.307	-0.394	-.651*	-0.506	-0.583	-.661*	-0.602	-.740*	-0.551	-.749*	0.354	.786**
	Gyms - proximity to residences	-0.105	-0.269	-0.399	-0.221	-0.077	-0.266	-0.444	-0.620	-0.505	-0.477	-0.392	-0.539	-0.508	-0.516	0.294	.825**
	Kindergartens or preschools - per person	.686*	-0.534	0.166	0.242	.691*	0.050	0.103	0.290	0.261	0.088	0.157	0.249	0.343	-0.277	0.396	0.232
	Kindergartens or preschools - proximity to residences	0.139	-0.177	0.521	0.384	0.281	0.227	0.395	0.219	0.452	0.248	0.324	0.519	0.475	0.618	-0.518	-0.357
	Libraries - proximity to residences	0.120	0.175	-0.121	-0.056	0.141	-0.143	-0.297	-0.559	-0.299	-0.136	-0.350	-0.204	-0.38	-0.019	-0.311	0.414
	Maternal child health centres - per person	0.146	0.030	0.173	0.087	-0.228	0.161	0.298	0.370	0.152	0.167	0.198	0.229	0.364	0.346	-0.215	-0.522
	Neighbourhood houses - per person	-0.434	0.130	0.258	0.235	0.045	0.292	0.218	-0.181	-0.087	0.304	0.036	0.136	0.136	0.422	-0.383	-.657*
	Packaged liquor licenses - per person	-0.207	-.738*	0.478	0.569	0.357				0.023	0.454	.721*	0.371	.651*	0.196	0.101	-0.239
	Packaged liquor licenses - proximity to residences	-.655*	-0.196	.792**	.678*	-0.079			0.236	0.311	.638*	.673*	.664*	.633*	.947**	-.660*	-.746*
	Parkland - Percentage	0.303	0.009	-.741*	-.638*	0.082			-0.432	-0.352	-.746*	-.705*	-.722*	-.633*	-.867**	.637*	.642*
	Pets - per person	.850**	0.082	-0.569	-0.536	0.110	-0.480	-0.482	0.248	-0.187	-0.473	-0.347	-0.377	-0.301	-.675*	0.537	0.57
	Playgrounds [flagship] - proximity to residences	0.151	0.010	-0.532	-0.422	0.121	-0.543	-.683*	-.713*	-0.564	-0.571	-.748*	-0.601	-0.621	-0.579	0.364	0.49
	Playgrounds [all public] - per person	0.426	-0.062	-0.491	-0.490	0.182	-0.622	-0.583	-0.218	-0.024	-.675*	-0.489	-0.448	-0.38	-0.527	0.322	0.532
	Playgroups - per person	-0.382	-0.177	0.463	0.380	0.075	0.612	0.624	0.623	0.087	0.511	0.595	0.452	0.548	0.453	-0.06	-.727*
	Poker machine venues - proximity to residences	0.339	-0.485	0.286	0.426	0.496	0.268	0.168	-0.199	-0.166	0.216	0.057	0.199	0.213	0.032	-0.031	0.193
	Primary schools - per person	0.322					0.514	0.498	0.406	0.129	0.375	0.527	0.468	0.558	0.131	0.083	0.113
	Primary schools – State -per person	-0.113	-.634*	.793**	.838**	.704*	.839**	.773**	0.369	0.301	.687*	.734*	.668*	.764*	0.538	-0.322	-0.392
	Primary schools – State- proximity to residences	-0.469	-0.171	.776**	.679*	0.077	.681*	.724*	0.158	0.252	0.625	0.587	.649*	0.58	.927**	-.727*	-.647*
	Public toilets - per person	0.567	-0.190		-0.421	0.448	-0.381	-0.567	-0.180	-0.311	-0.552	-0.456	-0.591	-0.386	-.790**	0.473	.659*
	Secondary schools - per person	0.446	0.486	-0.185	-0.241	-0.543	-0.268	-0.156	0.079	-0.215	0.016	-0.206	0.022	-0.22	-0.06	0.104	0.167
	Secondary schools – State - per person	0.380	0.259	0.121	-0.052	-0.457	-0.073	0.172	0.374	0.136	0.069	0.098	0.290	0.193	0.394	-0.258	-0.231
	Scout and guide halls - per person	0.219	-0.582	-0.135	0.026	.642*	0.142	-0.048	0.106	-0.006	-0.224	0.089	-0.252	0.105	-0.386	0.189	0.345
	Shelter shade - per person	0.275	-0.177	-0.626	-0.513	0.291	-0.531	-.678*	-0.418	-0.393	-.733*	-0.602	-.685*	-0.531	-.720*	0.441	.641*
	Sports fields - per person	0.349	0.034	-0.411	-0.401	0.333	-0.303	-0.406	-0.113	-0.145	-0.506	-0.398	-0.454	-0.229	-0.248	-0.083	0.076
	Sports fields - proximity to residences	-0.057	-0.545	0.434	0.418	0.521	0.314	0.376	0.145	0.299	0.194	0.283	0.333	0.537	0.297	-0.104	-0.493
	Train stations - proximity to residences	0.056	0.227	0.336	0.271	-0.281	0.156	0.235	-0.128	-0.028	0.331	0.079	0.355	0.101	0.534	-0.506	-0.134
	Trees [on street and open space] - per person	0.455	0.055	-.808**	-.686*	0.166	-0.624	-.803**	-0.398	-0.501				-.657*	-.812**	0.421	.659*
	Trees [open space] - per person	0.402	0.082	-.822**	-.691*	0.127	-.663*	-.847**	-0.513	-0.545				-.719*	-.826**	0.43	.685*
	Trees [street] - per person	0.532	-0.005	-.720*	-0.624	0.233	-0.496	-.651*	-0.129	-0.370				-0.478	-.723*	0.369	0.555
	Walking school bus stops - per person	.791**	0.219	-0.604	-0.600	-0.170	-.769**	-.656*	-0.144	-0.096				-0.477	-.632*	0.441	.691*
	Women's gyms - per person	0.313	-0.101	-0.612	-0.464	0.388	-0.436	-.661*	-0.476	-0.404				-0.53	-.662*	0.244	0.602
	Women's gyms - proximity to residences	0.037	0.263	-0.624	-0.523	-0.004	-.645*	-.753*	-.741*	-0.224				=-0.674*	-0.602	0.215	0.43
	Industrial zone - percent	-0.373	-.701*	0.126	0.225	0.236	0.434	0.323	0.356	-0.080	0.056	0.437	0.003	0.323	-0.156	0.394	-0.009

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Appendix C: List of maps

Section 2: Brimbank in context

Section 4: Analysing selected Brimbank indicators

4.4 Psychological distress reported as 'high' or 'very high

4.5 Hospitalisations for ambulatory care-sensitive conditions

4.6 Children developmentally vulnerable on one or more domain

4.6.11 Children developmentally vulnerable on one or more domains, by Brimbank PHA; Overlay for roads, accident black spots, and playgrounds

4.6.1 Children developmentally vulnerable on one or more domains, by Brimbank PHA; Overlay for bike paths and playgrounds.

Section 5: Discussion

5.1.1. Summary of patterns of socio-economic disadvantage by Brimbank PHA correlated with health outcomes or indicators