Advanced Melanoma –
The real cost of
Australia’s national
cancer

Prepared at the request of

mpa
Melanoma Patients Australia

October 2014
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Acknowledgements

KPMG would like to thank those people who have provided their valuable time and input into this project to highlight the individual journey people with advanced melanoma make.

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Members of the community seeking support or information about melanoma can contact Melanoma Patients Australia 1300 88 44 50.
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## Glossary and key terms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term</th>
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<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
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<tr>
<td>CT</td>
<td>Computed Tomography (scan)</td>
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<tr>
<td>DALY</td>
<td>Disability Adjusted Life Year</td>
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<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
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<td>GP</td>
<td>General Practitioner</td>
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<td>LDH</td>
<td>Lactate dehydrogenase</td>
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<td>Melanoma Patients Australia</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
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<tr>
<td>PD-1</td>
<td>Programmed cell death protein 1</td>
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<tr>
<td>UV</td>
<td>Ultraviolet</td>
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<tr>
<td>YLL</td>
<td>Years of Life Lost</td>
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</table>
Executive summary

Melanoma is Australia’s national cancer, with Australian’s experiencing 12 times the global average rate of melanoma. More than 12,500 new cases will be diagnosed in Australia in 2014 (Melanoma Institute Australia 2014b), and of these it is estimated that 1,543 will be diagnosed as advanced stage melanoma (KPMG calculation).

Every patient diagnosed with melanoma will experience significant impacts, however a diagnosis of advanced melanoma (stages III and IV) has devastating implications for patients, families and the community as whole.

Treatment of advanced melanoma is complex, associated with extremely unpleasant side effects and is relatively ineffective. While melanoma is generally curable if detected and treated early, there is only a five per cent chance of survival over five years for someone diagnosed at stage IV. The median survival is between 6-10 months.

It is not surprising then that lost productivity (due to premature death) and health care costs are the major contributors to the estimated cost of advanced melanoma, which was $422 million in 2014.

Objective

Melanoma Patients Australia (MPA) is a patient driven not-for-profit organisation providing support and information to people diagnosed with melanoma and their families and carers. MPA engaged KPMG to assess the financial and non-financial burden of melanoma in Australia.

The overall objective of this project was to provide an independent analysis of the financial and non-financial impact of advanced melanoma (defined as stages III and IV) on patients, carers, families and the community. In doing so the project has used publically available information to estimate:

- Incidence and prevalence of melanoma and advanced melanoma in Australia
- Annual mortality of advanced melanoma
- The treatment regime for advanced melanoma patients
- The economic costs associated with advanced melanoma.

What is melanoma?

Melanoma is the most deadly form of skin cancer, which is characterised by pigment cell mutation. It usually occurs on parts of the body that have been overexposed to UV rays, however it can also occur in parts of the body that have never been exposed.

There are five stages of melanoma. Early stage melanoma (stages 0, I and II) consists of a malignant tumour that has not spread. Advanced stage melanoma (stages III and IV) consists of a malignant tumour that has spread to either the lymph nodes or distant parts of the body, primarily to the lung, brain, liver, or bone.

1 Melanoma is one of three types of skin cancers. The other two are squamous cell carcinoma and basal cell carcinoma, which are the most common skin cancers. However, they have a reduced ability to spread through the body and most patients are treated successfully and make a full recovery.
The primary risk factors that make melanoma our national cancer are our outdoor lifestyle, high UV index and skin colour. Many children are exposed to UV light through surf lifesaving, school sport and other outdoor activities. Workers located in industries that consist of mostly outdoor activities (e.g., construction, mining and farming), are also exposed to extreme UV light for long periods of time.

It is estimated there will be 1,645 deaths due to advanced melanoma in 2014. Around 59 per cent will be male. There are expected to be more deaths from advanced melanoma than deaths from transport accidents, poisoning, or assaults.

Treating advanced melanoma

The journey for advanced melanoma patients from diagnosis to treatment, and then to recovery or death, can vary significantly. It can involve a combination of several therapies including surgery, radiation therapy, biological therapy, and chemotherapy depending on the progression of the disease.

For some people treatment is ineffective. For example, only 15 per cent of advanced melanoma patients respond to conventional chemotherapy treatment (and only one or two per cent will achieve complete disappearance), which is also associated with a high rate of side effects such as nausea, vomiting and anorexia.

For those patients who become terminally ill, the last months of their lives include rapidly deteriorating health in addition to the emotional roller-coaster of farewelling their family and loved ones and coming to terms with their own death. Some patients can have trouble communicating, or may experience hallucinations, if the disease has spread to their brain.

Family and friends also suffer. Depression and anxiety is experienced by 20 per cent of family members post a cancer diagnosis, with an increase to 35 per cent for spouses and 28 per cent of children in the palliative care phase. There is also increased responsibility for the primary carer, with family members having to take time off work, and needing to find alternative ways to financially support their family and perhaps pay for treatments.

Fortunately, new treatments are being developed with some promising results. These include therapies targeting particular proteins in cells, therapies that boost the immune system, and other treatments targeting the genes involved in melanoma occurrence and growth.

The economic cost of advanced melanoma

Advanced melanoma imposes a substantial cost on individuals, government and the rest of society. Costs estimated within this study include:

- health care and research costs;
- productivity loss;
- the cost of informal care; and
- the loss of healthy life to individuals.

The total cost of advanced melanoma was estimated to be $422 million in 2014. This cost is primarily associated with productivity loss (due to premature mortality), accounting for around 48 per cent. Health care cost is the second largest cost, accounting for 39 per cent (see Chart 1).

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2 The cost of comorbidities associated with advanced melanoma, such as anxiety and depression, has not been estimated in this study.
However, there are additional costs associated with advanced melanoma that have not been estimated due to a lack of reliable data. They include costs associated with counselling, additional aids for the patient, transport and accommodation costs, education materials and awareness campaigns.

There is also a loss of health associated with advanced melanoma. It is estimated that advanced melanoma will lead to 25,875 years of healthy life lost due to disability and premature mortality in 2014 (KPMG estimate).

Implications and considerations

There are significant financial and non-financial costs associated with advanced melanoma, along with personal and society level burden associated with this disease.

Ongoing investment in prevention and early detection is likely to maintain or reduce incidence over time, thereby reducing the costs associated with advanced melanoma, given the significantly reduced costs associated with diagnosis in the early stages of the disease.

This suggests that continued focus on public awareness, screening, improving access to cost effective treatments for advanced melanoma, and supporting research to develop new treatments is a worthwhile strategy to improving outcomes for patients and government.
1 Melanoma - Australia’s national cancer

Australia has the highest age-standardised incidence rate of melanoma in the world, with more than 12,500 new cases diagnosed in Australia every year. The incidence of melanoma is growing, with rates doubling over the 20 year period from 1986-2006 (AIHW 2012a).

While melanoma makes up only 2.3 per cent of all skin cancers, it is responsible for 75 per cent deaths associated with skin cancer and 3.4 per cent of deaths associated with all cancers (AIHW 2012a). Melanoma is the most common cancer for Australians aged 15 to 44 years (Parliament of Australia, 2014).

While melanoma is highly curable if detected and treated early, it can spread rapidly and be life threatening if left untreated. As such, the financial and non-financial impacts associated with melanoma can vary significantly according to the disease progression.

Recently, the Minister for Health, The Hon Peter Dutton MP, launched a House of Representative review into skin cancer in Australia. Since the launch of this inquiry eight public hearings have been completed around the country seeking to understand the awareness, prevention, early diagnosis and management of both melanoma and non-melanoma skin cancers (Parliament of Australia 2014b).

This chapter explores the reason for why melanoma is known as Australia’s national cancer. It presents research on:

- 1.1 What is melanoma?
- 1.2 Incidence of melanoma
- 1.3 What is advanced melanoma?
- 1.4 Incidence of advanced melanoma
- 1.5 Risk factors.

1.1 What is melanoma?

Melanoma is the most deadly form of skin cancer and develops from pigment cell mutation. Melanoma usually occurs on parts of the body that have been overexposed to UV rays, however it can also occur in parts of the body that have never been exposed, including the eyes and the lining of the mouth and digestive tract (Cancer Council 2013). Commonly moles initially change shape or colour as the melanoma grows. This is shown in
In a healthy person, cells of the body divide and multiply in a controlled manner. Cancer occurs when the genetic makeup of a cell has been modified, which leads to mutated, rapidly developing cells that lack the function of the original cell type (Cancer Council NSW 2012).

There are two other types of skin cancer that are much less threatening - squamous cell carcinoma and basal cell carcinoma. Squamous and basal cell carcinoma are the most common skin cancers. These two carcinomas have a reduced ability to spread through the body (compared to melanoma) and most patients are treated successfully and make a full recovery. Almost all squamous and basal cell carcinomas would be removed by the treating physician either by scraping, burning, freezing or surgically excising the carcinoma. Further treatment could then include ointments or radiation.

1.2 Incidence of melanoma

Incidence refers to the number of new cases of melanoma each year. Australia has the highest incidence of melanoma in the world, and the risk is heightened for men and for those over 50 years of age.

Melanoma is the fifth most common form of cancer in Australia. It is estimated that 12,544 people will be diagnosed with melanoma in 2014, which means that one in seventeen Australians is expected to be diagnosed with melanoma before the age of 85.

The number of new cases has increased from 8,692 in 2000, equating to a 44 per cent increase, or an average 3 per cent increase annually (see Table 1 and Table 2). New cases are forecasted to continue rising, with 17,570 new cases of melanoma expected in 2020 (AIHW 2014a).

The high incidence is attributed to a combination of risk factors, including exposure to UV light in childhood and adolescence, and fair skin complexion within the population (see section 1.5 for more about risk factors).

Table 1 and Table 2 show incidence for males and females by age group. Males are 1.6 times more likely to be diagnosed with melanoma (Cancer Institute NSW 2014). The most number of new melanoma cases occur for males and females over 50 years old.
The incidence of melanoma is decreasing for both males and females between 0-29 year olds. This suggests that the sun safety campaigns introduced in the 1980s may be beginning to have a material effect on the incidence of the cancer in young people. It has been suggested that older people damaged their skin prior to the introduction of sun safety campaigns, whereas younger people were influenced to change their behaviour before developing poor behaviours related to sun exposure (AIHW 2014a).

### Table 1: Incidence of melanoma amongst males in Australia

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<td>24</td>
<td>20</td>
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<td>1,344</td>
<td>1,573</td>
<td>1,662</td>
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<td>1,421</td>
<td>1,347</td>
<td>1,483</td>
<td>1,548</td>
<td>1,615</td>
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<td>80+</td>
<td>485</td>
<td>608</td>
<td>756</td>
<td>818</td>
<td>1,070</td>
<td>1,066</td>
<td>1,224</td>
<td>1,346</td>
</tr>
<tr>
<td>Total</td>
<td>4,884</td>
<td>5,597</td>
<td>5,582</td>
<td>6,076</td>
<td>6,487</td>
<td>6,700</td>
<td>7,093</td>
<td>7,440</td>
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</table>

Source: ACIM (2014); KPMG calculations.

### Table 2: Incidence of melanoma among females in Australia

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<td>30-39</td>
<td>515</td>
<td>471</td>
<td>445</td>
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<td>467</td>
<td>428</td>
<td>422</td>
<td>409</td>
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<tr>
<td>40-49</td>
<td>669</td>
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<td>678</td>
<td>720</td>
<td>719</td>
<td>745</td>
<td>752</td>
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<tr>
<td>50-59</td>
<td>678</td>
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<td>877</td>
<td>839</td>
<td>956</td>
<td>914</td>
<td>982</td>
<td>1,021</td>
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<tr>
<td>60-69</td>
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<td>674</td>
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<td>713</td>
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<td>803</td>
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<td>80+</td>
<td>407</td>
<td>507</td>
<td>505</td>
<td>603</td>
<td>622</td>
<td>677</td>
<td>760</td>
<td>818</td>
</tr>
<tr>
<td>Total</td>
<td>3,808</td>
<td>4,231</td>
<td>4,258</td>
<td>4,304</td>
<td>4,581</td>
<td>4,705</td>
<td>4,930</td>
<td>5,104</td>
</tr>
</tbody>
</table>

Source: ACIM (2014); KPMG calculations.
1.3 What is advanced melanoma?

Melanoma is classified according to five stages which consider the characteristics of the tumour and the extent to which the melanoma has spread to lymph nodes or other parts of the body (metastasised) (see Table 3). In addition there are sub stages that further define the stage of disease by assessing ulceration formation, number of lymph nodes involved and the location of metastasis.

Patients with stages 0-II melanoma have a drastically different patient experience than those diagnosed with advanced disease. Early stage patients require excision of the melanoma and late stage II patients may also have a lymph node biopsy to confirm no disease spread. These patients would not require any further invasive treatment, but would participate in regular check-ups as their chance of further melanoma is increased. These would normally be completed by their General Practitioner (GP) or skin cancer specialist.

Advanced melanoma spreads either through the lymphatic system by invading the lymph nodes, or through transportation within the blood. When melanoma spreads small cells of the original melanoma travel and attach to other parts of the body and start to multiply rapidly, invading tissue and cells at the secondary site. The cancer is then said to have metastasised.

**Table 3: Stages of melanoma**

<table>
<thead>
<tr>
<th>Early stage Melanoma</th>
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<tbody>
<tr>
<td><strong>Stage 0:</strong> The tumour is confined to the epidermis and has not spread. Tumours of &lt;0.1mm thickness are classified as stage 0.</td>
</tr>
<tr>
<td><strong>Stage I:</strong> The tumour has not spread, there may or may not be ulceration. Tumours of &gt;0.1mm but &lt;2mm in thickness are classified as stage I.</td>
</tr>
<tr>
<td><strong>Stage II:</strong> The tumour has not spread, but there is ulceration. Tumours with these characteristics are &gt;2mm thickness are classified as stage II.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advanced Melanoma</th>
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</thead>
<tbody>
<tr>
<td><strong>Stage III:</strong> The tumour has spread to the lymph nodes but not to other distant body parts, and there is ulceration.</td>
</tr>
<tr>
<td><strong>Stage IV:</strong> the tumour has spread beyond the regional lymph nodes and to other distant parts of the body.</td>
</tr>
</tbody>
</table>

Source: KPMG.
1.4 Incidence of advanced melanoma

Data on the incidence of melanoma diagnosed at each stage in Australia is scarce. Although there is no one data source for Australia, data from the NSW Cancer Registry suggests 84 per cent of melanoma is diagnosed in the early stages, while 12.3 per cent is diagnosed in the advanced stage, including 7.7 per cent at stage III, and 4.6 per cent at stage IV (Cancer Institute NSW 2010).

These statistics accord with international studies. The Cancer Research UK estimates that the proportion of total melanoma diagnoses that are at stage III and stage IV is approximately 12.4 per cent (Cancer Research UK, 2014). Similar results have been found in the US. For example, a study of melanoma incidence between 1990 and 2004 in Florida found around 12 per cent of white non-hispanics had either regional or distant-stage melanoma at diagnosis (Hu et al, 2009).

It is estimated there will be 1,543 new cases of advanced melanoma in 2014. Of these, 966 will be diagnosed stage III, and 577 will be diagnosed stage IV.3 Historical trends and projections of advanced melanoma are presented in Figure 2.

Trends in the incidence of advanced melanoma reflect those of all melanoma. The incidence among both men and women are estimated to increase between by 52 per cent for males and 34 per cent for females between 2000 and 2014.

Patients who are initially diagnosed with stage III or stage IV melanoma may have missed early warning signs and either not noticed skin changes, or perhaps dismissed them as a mole or age spot. Participation in screening programs and increasing awareness about melanoma risks and early signs are important ways to manage the incidence of advanced melanoma.

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3 This was calculated by multiplying the number of people diagnosed with melanoma by the proportion of total melanoma diagnoses that are in advanced stages.
1.5 Risk factors

The risk factors for melanoma include exposure to UV light, increasing age and skin type. Given these risk factors, it’s not hard to see how melanoma has become Australia’s national cancer.

1.5.1 Exposure to UV light

Increased risk of melanoma comes from short, intense periods of exposure to UV radiation. Commonly this could occur through sun baking, while using a tanning bed and during sporting participation or viewing (Cancer Council Victoria 2012). Sunburn at any age also increases risk of skin cancer, with repeated episodes of sunburn and blistering in childhood and adolescence significantly increasing the risk for future melanoma (Melanoma Institute Australia 2014a).

According to the World Health Organisation (WHO), Australia has the highest UV index of any country that is a predominantly Caucasian population. A UV rating between eight and ten is considered ‘very high’ and over eleven is ‘extreme’. Darwin, for example, has an extreme UV rating for seven months of the year with a very high ranking for the remaining five months (World Health Organisation 2014).

In addition to this, the typical Australian lifestyle results in increased UV light exposure and therefore risk of developing melanoma. Many children are involved in surf lifesaving, school sport and outdoor extracurricular activities. Workers from the construction industry and farming are also required to be outside for long periods of their working day.

Sun exposure awareness has increased over time through initiatives like the Slip. Slop, Slap campaign. This catchy campaign highlighted the precautions that should be taken to limit exposure when outside, however due to a consistently high UV index, sunburn and UV exposure is difficult to eliminate altogether.
1.5.2 Age
Melanoma is rarely seen in children and risk increases with age post puberty. Extreme and recurrent sun damage experienced as a child and adolescent can result in melanoma formation later in life (Melanoma Institute of Australia 2011).

1.5.3 Skin type
Caucasian (Anglo Saxon/ Celtic) races have a significant increased risk of developing melanoma compared with a substantially lower risk in Asian and dark-skinned races. In general, Caucasians have poor tanning ability, freckling of the skin, red or fair hair, or blue or green eyes (Melanoma Institute of Australia 2011).

In the 2011 Census over 300 ancestries were separately identified (see Chart 2). The most commonly reported were English (36 per cent) and Australian (35 per cent). A further six of the leading ten ancestries reflected European heritage with the two remaining ancestries being Chinese (4 per cent) and Indian (2 per cent).
Chart 2: Proportion of Australians by ancestry

Note: Chart presents collective responses to the question “What is the person’s ancestry?”, as some people stated two ancestries, the total persons for all ancestries exceed 100 per cent.

2 The impact of advanced melanoma

The true impact of advanced melanoma is vast and varied. At stage III diagnosis, patients are launched into a journey of surgery, medication and an unknown stressful future of disease management and recurrence monitoring.

Many stage IV patients are faced with the unfathomable process of accepting their mortality and as well as fighting hard to extend their life, if only by a few months. The emotional and physical impact on the patient and all those around them can take over every part of their lives.

This chapter explores the devastating impact of advanced melanoma on patients and families. It includes:

- 2.1 Impact of advanced melanoma on patients
- 2.2 Impact of advanced melanoma on family and friends
- 2.3 Mortality associated with advanced melanoma.

2.1 Impacts on patients

Every person diagnosed with melanoma experiences a different journey, managing different challenges within their own personal, family and community context. The impacts of advanced melanoma include both the physical and psychosocial, and may differ depending on whether the patient is in active treatment or palliative care.

2.1.1 Physiological effects of advanced melanoma

Physically, melanoma is associated with a number of unpleasant and debilitating impacts for patients, many associated with the treatments as well as the disease itself.

In advanced melanoma physical effects are often associated with the spread of the disease to other vital organs in the body, which then fail to function properly. The most common sites melanoma spreads to, beyond lymph nodes and the skin, in stage IV patients are the lungs, brain, liver and bones (see Chart 2).

For patients that experience lung metastasis symptoms include coughing, coughing up blood, shortness of breath, dizziness, chest pain and weakness. Liver metastasis impact on the functioning of the liver (which can lead to decreased metabolism of medications including pain relief medication), jaundice, weight loss and painful abdominal swelling and distention.

When a patient has metastatic cancer in the brain, pressure can increase within the skull as a result of tumour growth. Symptoms can include decreased coordination, fever, lethargy, headache, memory loss, numbness, personality changes, rapid emotional changes, seizures, speech difficulties, visions changes, vomiting and weakness of the body.

Finally, bone metastasis invade the cartilage and bone marrow and cause mild to severe aches and pains within the patient. This pain can impact on weight bearing activity and can ultimately lead to immobility. If the metastasis are in the jaw region consumption of food becomes an extremely arduous and painful task.
As the disease progresses the burden of treatment may become unbearable for the patient. Patients may not be able to physically or mentally withstand further treatment and the focus moves to pain management and symptom control.

Patients can become dehydrated and may require an intravenous fluid infusion or a nasogastric tube inserted for feeding, due to lack of nutrients either being ingested or processed by the body.

There may be challenges controlling their pain due to decreased liver function and increased disease invasion, which often requires opioid infusions or injections. Patients on these powerful medications require constant assessment by care staff either within an acute care setting or through palliative care support in the home. Many of these opioid medications can lead to severe constipation and discomfort for the patient. Many patients also require oxygen therapy due to weakness and decreased lung function.

The goal for most late stage IV patients is symptom control and pain relief. Recent data found that despite patient wishes, about half of Australians die in hospital and a third in residential care, and a rise in hospital-based palliative care services was noted (Swerissen & Duckett, 2014).

2.1.2 The psychosocial impact on patients

Patients diagnosed with advanced melanoma are often shocked, as until this point many feel well and are unaware that the disease is present. After the initial cancer diagnosis many patients move through, at varying speeds, the stages of grief. These include the following typical responses.

- Denial: This can’t be happening to me. There must be a mistake in the results.
- Anger: I can’t believe how unfair this diagnosis is. I am so angry, why me.
- Bargaining: If only I had that mole checked years ago when I first noticed it. I should have been a better role model within my family.
- Depression: I feel like my life has no purpose. There are so many things I will never do.
• Acceptance: I have had a good life and I am not afraid of death.

Sadly, many patients may not have reached acceptance at the time of their death and may continue to experience anger and fear at the end of the lives.

Patients who are actively fighting the disease through treatment face challenges that most would not have experienced before. They may feel vulnerable and uncertain about the future, with over 77 per cent of advanced melanoma patients suffering from depression and anxiety (Navines 2009).

2.1.3 The journey through treatment

Treatment is at best unpleasant and at worst debilitating in its own right. The physical and psychosocial impacts are great, and there are also practical implications for families around providing care and loss of income.

Chemotherapy in particular is associated with nausea, vomiting and anorexia which can result in hospitalisation and further complications. Other side effects can include weight loss, low white blood cell count, infection, reduced mobility, coughing and shortness of breath (Hospira 2007).

Hair loss (alopecia) is another common side effect from both melanoma chemotherapy and radiotherapy, and although it is not painful it can lead to psychological consequences. Patients often feel exposed as others become aware of their illness. Patients with hair loss suffer higher depression and anxiety levels, low self-esteem and career related problems when returning to work. Many of these issues are exacerbated further in women (Hunt 2005).

Reduced libido is also common in advanced melanoma disease due to decreased self-esteem and is also as a side effect from treatment. Patients can feel like cancer is taking over every part of their life and can lead to relationship difficulties and a feeling of guilt from the patient.

Many patients also see their role within the family unit change, which can be the most significant quality of life change experienced (Revicki 2012). This results from the primary carer being physically weaker and uncomfortable with their changed status as a patient. The patient can experience increased stress from the financial burden they are placing on the family. If the patient is fortunate enough to experience an extended life these roles may never completely revert back, having lasting effects financially and emotionally for the patient and their family. There may be uncertainty about making future plans, as the direction of life is different than it was before.

2.1.4 The journey towards death

Sadly for many patients with advanced melanoma treatment aimed at fighting the cancer quickly gives way to palliative care.

Terminally ill patients have to deal with the unconscionable task of facing their own mortality and saying good bye to loved ones. An advanced melanoma diagnosis can result in a patient missing their son’s 21st birthday, not walking their daughter down the aisle and not celebrating their next wedding anniversary (see Case Study 1).

There are overwhelming mixed feelings of grief, regret, sadness and at times guilt about the diagnosis. Although many patients may put on a stoic front for their family, they are processing emotions far beyond comprehension inside.
The journey through to death is challenging not only for the patient but everyone involved in their care. As parts of the patient’s body begin to shut down there may be distressing physical changes. They may have inconsistent and laboured breathing with dryness of the mouth and lips. They can feel clammy, with their hands and feet cold to touch.

Most patients become incontinent, mainly driven by the fact that they are slipping in and out of consciousness. When the patient is conscious they may experience hallucinations which can be upsetting for family members. When the end of life is near breathing will slow and the patient may slip into unconsciousness and eventually their heart will stop beating.

The further challenge with advanced melanoma is the speed in which it spreads, meaning the final months are almost robbed from some patients. They quickly reach a point where the cancer has spread around the body and is impacting on their ability to communicate and connect with their loved ones. For patients with metastases in the brain lucid communication with family and loved ones may not be possible.

Case Study 1 – The experience of terminal illness

Herman was first diagnosed with melanoma in 2006 after three visits to his GP insisting that something was wrong. Eventually his GP took a biopsy and his results came back with confirmed stage III Melanoma. Herman went on to get his lymph nodes removed; the surgery went well and he was not prescribed further treatment. He also decided to find a new GP.

In 2012 the cancer returned and after successful spinal surgery and stereotactic radiation he was disease free.Sadly, in September 2013, Herman received the devastating news that his disease had spread throughout most of his internal organs and was now terminal.

Herman was treated at the Greenslopes Private Hospital and was placed on the BRAF and MEK inhibitor drug combination. This drug was not available on the PBS and access was gained through a special access scheme which was organised through his medical oncologist. Under this arrangement the cost was $80 per treatment cycle, due to large subsidisation from the pharmaceutical company.

While on the BRAF/MEK combination Herman had intense fevers, but the tumour shrinkage was significant. His wife Michelle saw them disappearing literally overnight and felt he was able to lead a relative normal life, and could keep his disease a private matter as he looked fit and healthy. He continued with treatment until May 2014, when he became treatment resistant.

Herman and Michelle decided to head to Europe on holidays, as they now knew their time together was precious and fading. Herman became very ill while they were travelling and once they returned home he was admitted to hospital. His tumour growth was now extreme, and Michelle soon counted 42 tumours visible on Herman’s body. They knew that it was now a race against time.

Herman then completed two cycles of Yervoy, however he experienced no disease control from this and sadly passed away the week he became eligible for PD1 treatment.

Herman was a known advocate in the melanoma space and spoke at many industry events. He personally connected with 27 other melanoma patients and sadly, most of these patients had a reduced life expectancy compared to Herman.

Herman has left behind a legacy of patient support and advocacy. He also sadly leaves behind his wife Michelle, five children and one grandson.
Overall an advanced melanoma diagnosis results in a patient’s life changing forever. Fortunate patients that reach remission have lifestyle readjustments including changed relationships with loved ones and potential anxiety around disease relapse. Terminally ill melanoma patients have to face their mortality in timeframes that are unimaginable, while dealing with the physical and psychosocial impacts of the disease and treatment.

2.2 Family and friends

Melanoma touches the lives of everyone around the patient, sometimes leading to devastating impacts for family and friends as well as patients. Family and friends will experience grief, guilt and an overwhelming sense of responsibility.

Depression and anxiety is experienced by 20 per cent of family members post any cancer diagnosis, with an increase to 35 per cent for spouses and 28 per cent of children in the palliative care phase (Australian Institute of Family Studies 2008).

At times a family member or friend may feel more distressed about the cancer diagnosis and even shut themselves away, as cancer is a reminder of their own mortality and morbidity (Cancer Council NSW 2013).

Parents may experience overwhelming feelings of guilt about failing to protect their children from the dangers of sun exposure. Partners may feel guilty that they have taken the patient for granted and children may experience intense feelings of loss and confusion, wondering how they will live without their parent guiding them through life.

The changing role of the patient results in increased responsibility from the family and friends. Partners may require time off or increased flexibility from work to complete all primary carer responsibilities and may need to look for alternative ways to financially support the family unit while the patient is sick.

Family and friends take on a huge responsibility in caring for the patient, and may want to form a tight bond with the treating physician, to ensure that the patient’s wishes are met. This is especially important for family of terminally ill patients, so they can advocate for their loved one. Seeing their loved one in pain can make them feel helpless and overwhelmed.

Overall family and friends are affected in so many different ways as they struggle to support the patient, while also processing what life might be like without them.

2.3 Mortality

Mortality due to melanoma is the number of deaths from melanoma in a given year. All deaths from melanoma are effectively deaths from advanced melanoma, as melanoma only results in death once it has metastasised (stages III and IV).
The five-year relative survival rate for all melanoma is around 88.5 per cent for men and 93.6 per cent for women (AIHW 2012).\(^4\) Obviously this varies significantly depending on what stage the disease has progressed to at the time of diagnosis. There have been improvements in survival rates over time, increasing from 85.8 per cent for 1982-1987 to 90.7 per cent for 2006-2010, which is likely a result of earlier and better screening, and more effective treatments for melanoma (AIHW 2012). The five-year relative survival rate for melanoma compares favourably with all cancers, which have a five-year relative survival rate of 66.1 per cent (AIHW, 2012).

However, survival when diagnosed with advanced melanoma is much worse. The chance of surviving five years if diagnosed with stage III is between 40-78 per cent, and for stage IV it is around five per cent (see Table 4).

Of those who die from advanced melanoma, the survival time from diagnosis is generally short due to the aggressive nature of the cancer. It is estimated that the median survival is between 6-10 months, and treatment over that period is relatively ineffective (Shepard et al 2010).

Table 4: Five year observed survival rates for each stage of melanoma

<table>
<thead>
<tr>
<th>Stage</th>
<th>5-year observed survival rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Early stage  Between 97 per cent (stage Ia) and 92 per cent (stage Ib)</td>
</tr>
<tr>
<td>Stage II</td>
<td>Between 81 per cent (stage IIA) and 53 per cent (stage IIC)</td>
</tr>
<tr>
<td>Stage III</td>
<td>Advanced  Between 78 per cent (stage IIIA) and 40 per cent (stage IIIC)</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Approximately five per cent</td>
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</table>

Source: American Cancer Society (2014).

While melanoma makes up only 2.3 per cent of all skin cancers, it is responsible for 75 per cent deaths associated with skin cancer and 3.4 per cent of deaths associated with all cancers (Melanoma Institute Australia, 2014b).\(^5\) Mortality due to melanoma is more common in men than in women, and increases with age (see Table 5 and Table 6). It is estimated that there will be 1,645 deaths due to advanced melanoma in 2014.

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\(^4\) One of the most common comparison measures of cancer mortality is the five-year survival rate (Mayo Clinic, 2005). These describe the percentage of individuals with melanoma that are alive 5 years after diagnosis, divided by the percentage of the age- and sex-matched population that are alive after 5 years (Gloeckler Ries et al, 2003).

\(^5\) Melanoma was responsible for 3.4 per cent of all cancer deaths in Australia in 2010.
### Table 5: Advanced melanoma deaths for males in Australia

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Source: ACIM (2014); KPMG calculations.

### Table 6: Advanced melanoma deaths for females in Australia

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<td>492</td>
<td>516</td>
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Source: ACIM (2014); KPMG calculations.
2.3.1 Comparison of advanced melanoma deaths

Advanced melanoma is a significant contributor to total cancer deaths in Australia. In 2012, advanced melanoma was ranked seventh in terms of the number of deaths (see Chart 4). The highest ranked contributor was malignant neoplasm of bronchus and lung. However, when comparing the years of potential life lost, advanced melanoma was ranked fifth, with 14,405 years of potential life lost (ABS 2012).

Deaths associated with advanced melanoma are also significant when compared to deaths not related to neoplasms. For example, there were more deaths associated with advanced melanoma than transport accidents, poisonings, and assaults (see Chart 5).

Chart 4: Top 15 cancers by mortality, 2012

Chart 5: Comparison of advanced melanoma deaths to selected other causes, 2012

- Intentional self harm
- Falls
- Malignant melanoma of skin
- Transport accidents
- Accidental poisoning by and exposure to noxious substances
- Assault

3 The complexities of treatment

This chapter describes the complex treatment pathway for advanced melanoma. It also explores some of the challenges people have faced accessing treatment through the use of case studies. In summary, it covers:

- 3.1 The patient journey
- 3.2 Treating advanced melanoma
- 3.3 Emerging therapies for advanced melanoma.

3.1 The patient journey

The journey for patients from diagnosis to treatment and then recovery or death can vary significantly. It will depend on the stage of disease at diagnosis (particularly whether or not the melanoma has metastasised), the location of metastases, the extent to which tumours are resectable, responsiveness to treatment and the preferences of the patient (see Case Study 2).

For those patients who successfully move through treatment, ongoing follow up is necessary as they continue to be at greater risk of developing melanoma in the future.

3.1.1 Diagnosis

Melanoma is usually first recognised from an examination of the skin undertaken by a general practitioner (GP) or a specialist. In conducting an initial examination, clinicians look for the following (‘ABCDE’):

A. Skin lesion asymmetry.
B. An irregular border.
C. Lesions with uneven colour.
D. Diameter (usually over 6mm).
E. Evolving (changing and growing) lesions.

An excision biopsy is performed if these characteristics are identified. Analysis of the biopsy will be undertaken to determine:

- Breslow thickness: The thickness of the lesion in millimetres.
- Clarke level: The level of invasion through the layers of skin.
- Margins: The closeness of the lesion to the edge of the excision specimen.
- Mitotic rate: The number of cells exhibiting mitosis (actively dividing).
- Ulceration: The impact on the epidermis of the skin and the level of breakdown.

Once melanoma is confirmed, patients with a high Breslow thickness may have either a fine needle aspiration or a sentinel node biopsy to determine lymph node involvement. A stage IV diagnosis is typically confirmed by undertaking a computed tomography (CT) scan or magnetic resonance imaging (MRI) scan and blood tests.

### 3.2 Treating advanced melanoma

#### 3.2.1 Early stage melanoma treatment

The treatment journey for patients diagnosed with early stage melanoma is relatively simple (see Figure 3). It includes day surgery to undertake a wide local excision of the skin and subcutaneous tissue around the melanoma.

The aim is to remove all invading melanoma cells through surgical excision, which can be confirmed through histological assessment. The surgery has relatively little impact on the patient’s quality of life and participation in usual activities, although some scarring may result.

#### 3.2.2 Advanced stage melanoma treatment

Treatment for advanced melanoma can involve a combination of several therapies including surgery, radiation therapy and chemotherapy depending on the progression of the disease and a range of factors which influence the likely success of each therapy (see Figure 3).

For patients diagnosed with stage III melanoma the treatment pathway will include more extensive surgery aimed at resecting both the tumour and affected lymph tissue, in addition to treatments targeting residual cancer cells and aimed at halting further spread of the disease throughout the body. For aggressive melanoma with extensive node disease the pectorals muscle in the axilla, superficial parotidectomy in the neck and obturator nodes in the pelvis may also be removed.

Patients diagnosed with stage IV melanoma may have surgery depending on where the cancer has metastasised, and the severity of the tumours. Treatment may be focused on symptom management and palliation where there is little opportunity to achieve remission.

Treatment for advanced melanoma may continue for over a year and many treatments are associated with unpleasant side effects, which can seriously impact on the patient’s quality of life and participation in work and leisure activities.

**Radiotherapy**

Radiotherapy is a localised treatment that uses radiation to damage cancer cells and stop them multiplying (Cancer Council Victoria, 2012). Radiotherapy may be used in combination with surgery and chemotherapy, or as a primary therapy when surgery is unsuitable.

Radiotherapy is typically delivered five days a week for four to six weeks. When radiation is used for palliative care, the course of treatment is shorter, usually one to two weeks (Melanoma Institute Australia, 2014).
Figure 3: Indicative patient journeys for melanoma.

Karen had a mole removed in February 2012, but was not aware of her increased risk of further disease and was understandably surprised by her diagnosis.

In February 2013 Karen discovered a lump under her right arm and was diagnosed with stage III melanoma. Karen had a mole removed in February 2012, but was not aware of her increased risk of further disease and was understandably surprised by her diagnosis.

For patients with advanced melanoma time is not on their side, and there is a need for a greater sense of urgency around access to new treatments.

Karen's journey began after her diagnosis of stage III melanoma. Karen had surgery to remove the tumour and lymph nodes.

Advanced melanoma

Against the advice of her doctors, Karen researched on-line and found preliminary clinical trial results that looked promising. Through communication with the pharmaceutical company MSD she confirmed that she could enter a clinical trial at the Austin in Melbourne for the treatment known as Keytruda. Karen lives in Adelaide so involvement in this trial required interstate travel to attend her appointments.

Case Study 2 – A patient driving her own treatment pathway

In Karen’s words ‘the drug has worked and the trial is magnificent’. The first scan (three months after trial initiation) showed an incredible result. Since she started the trial 12 months ago, tumour shrinkage has been noted at all but two of her six-weekly scans. The trial is due to stop working. She experienced swelling in her arm post-surgery and has worn a compression sleeve every day since. This swelling and the effect of radiotherapy has impacted her arm function and as a result she attends a physiotherapist every fortnight.

Karen was then told that the disease had spread further and was now unresectable stage IV, ineligible for a clinical trial underway at that time due to her specific tumour gene expression. Chemotherapy did not work and Yervoy (ipilimumab) was not yet available on the PBS. She was told that if chemotherapy did not work she would not have any more options.

Karen had surgery to remove the tumour and lymph nodes.

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**Biological therapy**

Biological therapies enhance the immune response to fight cancer, and are commonly used to treat stage III melanoma. These therapies are associated with a range of unpleasant side effects including headaches, tiredness and gastrointestinal discomfort.

Interferon-alpha2b is clinical best practice and improves relapse free survival by 10 per cent at five years (NHMRC 2008). It consists of an initial treatment period of four weeks followed by maintenance over a 48 week period. While the majority of patients would complete this regime, the significant side effects may require some dose modification.

**Chemotherapy and immune therapy**

Chemotherapy is used to kill melanoma cells that divide rapidly within the body. However, it also kills healthy cells within the body, thereby leading to significant unpleasant side effects such as depression of the immune system, nausea, vomiting, anorexia and diarrhoea.

The most commonly used chemotherapy is dacarbazine (DTIC), however temozolomide may be used for palliation of patients with stage IV melanoma. Treatment with dacarbazine (DTIC) includes daily infusions for five consecutive days, with cycles repeated every 21 days (Middleton 2000). Temozolomide is administered orally for five consecutive days, with treatment cycles repeated every 28 days in the absence of disease progression or toxicity.

Immune therapy aims to support the immune system to recognise abnormal cells and to halt cancer cell division (and hence growth). Ipilimumab was listed on the Pharmaceutical Benefits Scheme (PBS) in 2013 and is now recognised as the preferred treatment. Ipilimumab is administered by infusion, usually with four doses provided three weeks apart (i.e. treatment occurs over 12 weeks). Ipilimumab costs $110,000 for a 12 week cycle, in August 2013 the Health Minister announced subsidisation of this drug (Department of Health and Ageing 2013).

**Targeted treatments**

In approximately half of all patients with melanoma a mutation of the BRAF gene is found. In these cases dabrafenib may be indicated. This therapy has the potential to halt the rapid growth associated with melanoma. Dabrafenib is taken orally and treatment length will depend on the patient’s response and ongoing health. Treatment may occur over many months for some people.

**3.2.3 Follow up**

The nature of follow up will depend on the stage of melanoma at diagnosis and the response to treatment (Melanoma Centre 2014). Patients may require management and support for the ongoing effects of the cancer and treatment. These may include scarring and pain associated with surgery, lymphedema associated with removal of, and damage to, lymph nodes and psychological impacts including depression and anxiety (MPA 2006).

Patients and their doctors will determine the best course of follow up, however the following is indicative of usual follow up procedures.

**Early stage melanoma**

Patients diagnosed with stages 0 through II will be required to attended regular skin examinations every six months (three months for stage II) decreasing in frequency over a five year period if melanoma does not reappear.

Patients with stage II melanoma are expected to continue check-ups beyond five years, recognising that stage II tumours present a higher risk of recurrence. Some patients diagnosed with a more advance form of stage II tumour may also be tested for serum lactate dehydrogenase (LDH), an indicator of cancer cell metabolism.
Advanced melanoma

Patients with stage III melanoma will initially be monitored every three months, with check-up frequency decreasing over time but continuing beyond five years. These patients will receive much more comprehensive testing at each check-up, including a skin examination, chest x-rays, serum LDH testing, and CT scans.

Patients with stage IV melanoma are considered to be in active treatment, and their monitoring regime will be determined according to their clinical presentation.

Case Study 2 – A patient driving her own treatment pathway

In February 2013 Karen discovered a lump under her right arm and was diagnosed with stage III melanoma. Karen had a mole removed in February 2012, but was not aware of her increased risk of further disease and was understandably surprised by her diagnosis.

Karen had her lymph nodes removed and required a permanent medical draining device over the next three months, and she was also receiving adjuvant radiotherapy. At this point Karen stopped working. She experienced swelling in her arm post-surgery and has worn a compression sleeve every day since. This swelling and the effect of radiotherapy has impacted her arm function and as a result she attends a physiotherapist every fortnight.

Karen was then told that the disease had spread further and was now unresectable stage IV, and that while chemotherapy was an option, success rates were variable. Karen was ineligible for a clinical trial underway at that time due to her specific tumour gene expression. She was told that if chemotherapy did not work she would not have any more options. Chemotherapy did not work and Yervoy (ipilimumab) was not yet available on the PBS.

Against the advice of her doctors, Karen researched on-line and found preliminary clinical trial results that looked promising. Through communication with the pharmaceutical company MSD she confirmed that she could enter a clinical trial at the Austin in Melbourne for the drug Keytruda. Karen lives in Adelaide so involvement in this trial required interstate travel every two weeks.

Karen was placed in the group that was receiving the highest does of the active drug, rather than the group receiving Yervoy. This was relief for Karen and her family given the financial and emotional investment they made to participate in the trial. Karen almost missed out on involvement in the trial due to delays and her declining health.

In Karen’s words ‘the drug has worked and the trial is magnificent’. The first scan (three months after trial initiation) showed an incredible result. Since she started the trial 12 months ago, tumour shrinkage has been noted at all but two of her six-weekly scans. The trial is due to continue for another 12 months.

Karen feels that if she was not ‘pushy’ she would not have had access to this treatment. She feels that the patient experience varies largely depending on the treating hospital and doctor. For patients with advance melanoma time is not on their side, and there is a need for a greater sense of urgency around access to new treatments.

Karen has managed to return to work one day a week and is grateful for the support of her employer and colleagues. She has a loving husband and three children and mother who have supported her through this journey, and has a list of friends who provide her with an ‘airport shuttle service’.
3.3 Emerging therapies for advanced melanoma

Advanced melanoma is difficult to treat, and until recently most treatments have not led to significantly improved survival rates (Melanoma Institute Australia 2014). However, new treatments are being developed and trialled internationally with some promising results.

**Therapies targeting BRAF V600-positive metastatic melanoma**

BRAF is a naturally occurring protein found in cells and is associated with growth. It is controlled by a gene, and in around 50 per cent of people with melanoma the BRAF gene is found to have mutated (called the BRAF V600 mutation) causing excessive cell growth.

Currently dabrafenib is the only approved treatment targeting cells with the BRAF V600 mutation, however other therapies are being used internationally that can target the disease in a similar way.

Vemurafenib is a targeted therapy that also focuses on the BRAF gene. In a phase III clinical trial of stage III and IV melanoma patients, vemurafenib showed an overall survival improvement of 63 per cent and progression-free survival of 74 per cent over patients receiving dacarbazine (Chapman 2011). Vemurafenib received Food and Drug Administration (FDA) approval in the United States in 2011, and Health Canada and European Commission approval in certain cases in 2012.

Despite being approved for use by the Therapeutic Goods Administration (TGA) in Australia vemurafenib is not listed on the PBS. This limits access for people unless they can raise sufficient funds to pay for the drug themselves or can access a clinical trial or compassionate-use program. The Pharmaceutical Benefits Advisory Committee (PBAC) has deferred recommending vemurafenib be listed in order to seek clarification on its appropriateness for the Australian population and price (Australian Government 2013).

**PD-1 pathway treatments**

Treatments targeting the programmed cell death protein 1 (PD-1) pathway may boost the immune system and assist in the treatment of melanoma. In September 2014 the FDA awarded accelerated approval for pembrolizumab for use following ipilimumab treatment.

Pembrolizumab increases the immune system’s capacity to fight melanoma by blocking the interaction between PD-1 and its ligands (Meark 2014). The drug cost is approximately $12,500 a month (Loftus, 2014) and Australia is only the second country to be given access after the United States (Donovan, 2014). A similar therapy is being developed by BMS under the trade name Opdivo (nivolumab). It has generated phase III data and has been approved in Japan.

Nivolumab is an immunotherapy currently being investigated. Trial results show that metastatic melanoma patients treated with nivolumab experienced an overall median survival of 16.8 months, and one and two year survival rates were 62 per cent and 43 per cent, respectively (Topalian 2014). These results supported the value of the PD-1 pathway in melanoma treatment. Nivolumab is not listed on the PBS.

**Other treatments**

There are various other treatments currently being developed, including a range of immunotherapies and treatments targeting the genes involved in melanoma occurrence and growth. For example, imatinib has shown some benefits for patients with melanoma that have the KIT mutation (Hodi 2013). Targeted therapies have shown benefits in treatment of lung and breast cancers, and this is a new direction in melanoma research.
One of the challenges facing melanoma patients is that approval for new treatments in Australia can be delayed compared to the United States. This is particularly the case for treatments to be listed on the PBS (see Case Study 3).

In the absence of PBS subsidisation, some advanced melanoma treatments may cost hundreds of thousands of dollars. Some patients may be accepted into clinical trials, or access treatments through compassionate use programs, however these are general time limited and not available to all.

**Case Study 3 – Treatment from the perspective of a specialist**

Professor Mark Smithers has been performing surgery on melanoma patients since 1987 and has been a Director of the Queensland Melanoma Project and Senior surgeon to the multidisciplinary melanoma clinic at the Princess Alexandra Hospital in Brisbane for over ten years.

The multidisciplinary team consists of medical and radiation oncologists, palliative care team, social workers, nursing staff, research team and radiologists who provide the best combined care possible for patients.

Only in the past four years has Mark seen real advancements in the treatment of stage III and IV melanoma. When compared to other common cancers, which have benefited from a lot of funding and research, Mark feels that melanoma has been a good ten years behind until now, as new advances are finally getting to the clinic.

There is no typical treatment path for advanced melanoma. Stage III patient’s require regular clinical review and skin surveillance by the patient’s GP, dermatologist, surgeon, or skin specialist. This may be combined with CT scans to regularly review disease presence or progressions. Patients with stage IV disease will have regular scans and blood tests to assess whether any of the treatments being offered by the oncologists are having an effect. This is a very intense time as the chance of a positive effect from treatment is low.

The PA Hospital regularly participates in clinical trials. They have recently seen promising results with the BRAF/MEK inhibitor and Yervoy therapy. The frustration, however, lies around the extended time lag between trials finishing, publication of results and TGA approval and inclusion of the drug on the PBS.

Mark believes that there is a gap in medications currently subsidised by the PBS, and would like to see the MEK inhibitor and in the near future the PD1 pathway molecule approved and supported by the government, ideally soon after the evidence has been assessed by the TGA. Currently some non-PBS listed medications are available through special access schemes from their respective pharmaceutical companies. He believes companies spend an enormous amount of money on the research and development of these molecules, and approval must progress in a timely way to ensure continued access to life changing medications.

The other hurdle to treatment suggested by Mark is access to clinical trials for regional patients. There are times that financial support is not available for these patients to participate in clinical trials, making involvement challenging for both the doctor and the patient.

In the past stage IV patients were diagnosed and went off into the sunset, as there were limited treatment options. Now there are good clinical trial results and Mark has seen miraculous changes for some patients.

In an ideal world Mark would like to see the profile of melanoma improved at government and community level.
4 The substantial cost of advanced melanoma

Advanced melanoma imposes a substantial cost on individuals, government and the rest of society.

This chapter presents estimates of the total cost, including:

- 4.1 Total cost of advanced melanoma
- 4.2 Health care and research costs
- 4.3 Productivity loss
- 4.4 Cost of informal care
- 4.5 Disability Adjusted Life Years.

The methodology used to estimate costs is presented in Appendix A.

Advanced melanoma imposes a significant burden on the health of an individual throughout treatment, and can ultimately result in death. However, there is also a significant cost associated with treating advanced melanoma. Costs estimated in this chapter include the following.

- Health care costs: This includes the cost of running health care institutions, paying care and administration staff, providing diagnostics and pharmaceuticals, and undertaking research to improve treatment outcomes.
- Productivity loss. This includes temporary reduced workforce participation associated with absenteeism, and a permanent reduction in workforce participation through premature retirement and premature mortality.
- The cost of informal care: This includes the loss of productivity and leisure time for those family and friends providing informal care to someone with advanced melanoma.
- The loss of healthy life: This includes the amount of healthy life a person loses due to advanced melanoma, and includes time lived with the illness and premature mortality.

These costs impact the patient, their family, friends, employers, government and the broader society.

However, there are additional costs that have not been estimated due to a lack of reliable data. They include costs associated with counselling, additional aids for the patient, transport and accommodation costs, education materials and awareness campaigns. Some costs, such as those associated with ongoing depression and grief, are difficult to quantify, although they are no less real. There is also a substantial cost associated with being on clinical trials that has not been captured (see Case Study 4). Consequently, the total cost presented in this report may be considered an underestimate.
Case Study 4 – Surviving against all odds

Daphne was diagnosed in May 2008 with stage IV melanoma. She had metastasis present in her lung and a short time later in her adrenal gland and bowel.

Daphne was originally told that lung metastasis have no impact on the patient’s life and that treatment was not advised anyway, as she would not be able to withstand the side effects. Daphne decided to get a second opinion and yet again was told that nothing could be done to save her.

In October 2008 Daphne’s tenacious attitude led her to Greenslopes Hospital in Brisbane where a specialist completed tumour profile testing and placed her on a clinical trial that looked at disease improvement through the re-injection of a vaccine that contained, among other components Melanoma cells, BCG and her white blood cells. This small trial of twelve patients was made possible through funding secured by the specialist. At the end of the clinical trial Daphne’s lung tumour had significantly shrunk, yet the adrenal gland tumour was still present.

The original funding pool was now depleted and Daphne was asked to pay $10,000 to continue on treatment as a private patient. Daphne and her husband decided that the treatment was worth the cost, given the good results they had already seen.

Over the next five and half years Daphne regularly travelled from the Sunshine Coast to Brisbane on the train to continue these injections and has been since labelled a ‘miracle’. Her regular six monthly scans showed continued tumour shrinkage to the point there are currently no signs of active melanoma. Her last injection was in April 2014 and the treatment ceased because the laboratory closed due to withdrawn funding. Daphne and her specialist are waiting and watching, as he does not have the option of giving further injections now (because the lab has closed).

Daphne has a very close relationship with her GP and uses the internet to source information. Throughout her treatment she has made use of complementary treatments including vitamin C infusions, vitamin B injections and multiple oral supplements which have cost her $200-$400 per month.

Daphne has maintained a positive attitude throughout her treatment and sees herself as a victor and not a victim. Other than a recent hip replacement, Daphne says she just ‘feels so well’.

Daphne believes that you can’t judge a book by its cover, and she sees that this is true for cancer patients, who can go to great lengths to improve their own outcomes.

Daphne believes that one web site where all clinical trial options are listed would be of great help to melanoma patients and doctors. Daphne was also pivotal in the establishment of the Melanoma Patients Australia support group on the Sunshine Coast and has only ever missed meetings dues to health concerns.
4.1 Total cost of advanced melanoma

The total cost of advanced melanoma was estimated to be $422 million in 2014. The primary cost is associated with productivity loss associated with premature mortality, accounting for around 48 per cent. Health care cost is the second largest cost, accounting for 39 per cent (see Chart 6).

Chart 6: Distribution of total estimated cost of advanced melanoma, 2014

Source: KPMG calculations.

There is also a loss of health associated with advanced melanoma. It is estimated that advanced melanoma will lead to an equivalent loss of 25,875 years of healthy life in 2014 due to disability and premature death.

4.2 Health care and research costs

Health care cost estimates were based on the adjusted cost of melanoma presented by AIHW (2014a) and new pharmaceutical therapies recently introduced into Australia. A bottom-up costing of the typical treatment pathway for a patient with Stage I and II melanoma was used to separate the cost of Stage I and II melanoma from the overall cost of melanoma, and the remaining cost was considered as a measure of the cost of advanced melanoma.

6 Average health inflation since 2008-09 was calculated using AIHW (2014b).
The total health care cost for advanced melanoma is estimated to be $163.9 million in 2014. This equates to an average cost of approximately $106,000 per new case of advanced melanoma.

Including the annual cost of research, the total health care and research costs of advanced melanoma was estimated to be $166.5 million for 2014.

### 4.3 Productivity loss

Productivity loss is associated with a reduction in workforce participation, either temporarily through absenteeism while a person with advanced melanoma goes through treatment, or permanently through either early retirement based on the experience of going through treatment, or premature death for those in working age.

The total cost of lost productivity associated with advanced melanoma is estimated to be $231.6 million in 2014 (see Table 7). This equates to an average productivity loss for someone in working age with advanced melanoma of $276,000.

The largest component of productivity loss is associated with premature death. It accounts for around 87 per cent of the total.

The bulk of the productivity loss is associated with people aged between 45-60 years (see Chart 7). In particular, males between this age group impose a significant productivity loss due to the larger number of deaths. For example, it is estimated there are nearly twice as many male deaths in this age group in 2014 compared to females.

**Table 7: Overall productivity costs of advanced melanoma, 2014**

<table>
<thead>
<tr>
<th>Type of cost</th>
<th>Cost ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary absenteeism</td>
<td>19.3</td>
</tr>
<tr>
<td>Premature retirement</td>
<td>11.0</td>
</tr>
<tr>
<td>Premature mortality</td>
<td>201.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>231.6</strong></td>
</tr>
</tbody>
</table>

*Source: KPMG calculations.*
4.3.1 Temporary absenteeism

Temporary absenteeism was calculated by estimating the lost income of employed persons with advanced melanoma. Calculations were based on the assumption that survivors of advanced melanoma are absent from work for an average of 201.8 days while they go through treatment and recover from their illness (Short et al 2005).

The overall productivity cost of temporary absenteeism due to treatment for advanced melanoma is estimated to be $19.3 million in 2014. The distribution of costs between age groups and gender is shown in Table 8.
Table 8: Productivity costs of temporary absenteeism by age group and gender, 2014

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males ($ '000)</th>
<th>Females ($ '000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19</td>
<td>24.7</td>
<td>14.7</td>
</tr>
<tr>
<td>20–24</td>
<td>144.2</td>
<td>131.0</td>
</tr>
<tr>
<td>25–29</td>
<td>325.9</td>
<td>277.4</td>
</tr>
<tr>
<td>30–34</td>
<td>603.7</td>
<td>353.7</td>
</tr>
<tr>
<td>35–39</td>
<td>960.0</td>
<td>555.2</td>
</tr>
<tr>
<td>40–44</td>
<td>1.1</td>
<td>704.3</td>
</tr>
<tr>
<td>45–49</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>50–54</td>
<td>2.4</td>
<td>1.1</td>
</tr>
<tr>
<td>55–59</td>
<td>3.0</td>
<td>1.1</td>
</tr>
<tr>
<td>60–64</td>
<td>2.8</td>
<td>838.1</td>
</tr>
<tr>
<td>65–69</td>
<td>160.0</td>
<td>25.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13,172.7</strong></td>
<td><strong>6,136.7</strong></td>
</tr>
</tbody>
</table>

Source: KPMG calculations.

4.3.2 Premature retirement

The cost of premature retirement was calculated by estimating the lost income of employed persons who survive advanced melanoma but do not return to the workforce. Calculations were based on the following assumptions:

- approximately 84 per cent of all advanced melanoma survivors above the age of 40 years return to work, while the remainder do not (Short et al 2005); and
- survivors of advanced melanoma would otherwise retire at 65 years old.

The overall productivity cost of premature retirement due to advanced melanoma is estimated to be $11.0 million in 2014. The distribution of costs between age groups and gender is shown in Table 9.
Table 9: Productivity costs of premature retirement by age group and gender, 2014

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males ($ ’000)</th>
<th>Females ($ ’000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20–24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>25–29</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30–34</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>35–39</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>40–44</td>
<td>1,849.0</td>
<td>1,330.6</td>
</tr>
<tr>
<td>45–49</td>
<td>1,096.8</td>
<td>2,101.2</td>
</tr>
<tr>
<td>50–54</td>
<td>2,048.7</td>
<td>1,134.2</td>
</tr>
<tr>
<td>55–59</td>
<td>109.1</td>
<td>946.4</td>
</tr>
<tr>
<td>60–64</td>
<td>67.1</td>
<td>290.4</td>
</tr>
<tr>
<td>65–69</td>
<td>-</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,170.6</strong></td>
<td><strong>5,803.6</strong></td>
</tr>
</tbody>
</table>

Note: It was assumed that all people with advanced melanoma aged less than 40 years would return to work. Source: KPMG calculations.

4.3.3 Premature death

The cost of premature death was calculated by estimating the lost income of employed persons who die from advanced melanoma. Calculations were based on the assumption that advanced melanoma survivors would otherwise retire at 65 years old.

The overall productivity cost of premature mortality due to advanced melanoma is estimated to be $201.3 million in 2014. The distribution of costs between age groups and gender is shown in Table 10.
**Table 10: Productivity costs of mortality by age group and gender, 2014**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males ($) '000</th>
<th>Females ($) '000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>202.7</td>
<td>-</td>
</tr>
<tr>
<td>5–9</td>
<td>319.6</td>
<td>-</td>
</tr>
<tr>
<td>10–14</td>
<td>-</td>
<td>4.2</td>
</tr>
<tr>
<td>15–19</td>
<td>-</td>
<td>10.5</td>
</tr>
<tr>
<td>20–24</td>
<td>-</td>
<td>1,273.2</td>
</tr>
<tr>
<td>25–29</td>
<td>5,865.2</td>
<td>4,882.2</td>
</tr>
<tr>
<td>30–34</td>
<td>12,371.7</td>
<td>1,408.1</td>
</tr>
<tr>
<td>35–39</td>
<td>14,871.4</td>
<td>6,277.3</td>
</tr>
<tr>
<td>40–44</td>
<td>13,932.6</td>
<td>9,634.4</td>
</tr>
<tr>
<td>45–49</td>
<td>25,175.7</td>
<td>9,179.9</td>
</tr>
<tr>
<td>50–54</td>
<td>25,320.1</td>
<td>11,361.3</td>
</tr>
<tr>
<td>55–59</td>
<td>30,743.0</td>
<td>8,663.7</td>
</tr>
<tr>
<td>60–64</td>
<td>15,263.5</td>
<td>4,122.0</td>
</tr>
<tr>
<td>65–69</td>
<td>324.2</td>
<td>89.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>144,389.7</strong></td>
<td><strong>56,906.5</strong></td>
</tr>
</tbody>
</table>

*Sourc: KPMG calculations.*

### 4.4 Cost of informal care

Informal care is the provision of unpaid care by family and friends to someone with advanced melanoma. It is most commonly provided by a family member, friend or community member.

The cost of informal care was calculated by estimating the forfeited income of individuals providing informal care to someone with advanced melanoma. Calculations were based on the following assumptions:

- the average number of hours of informal care provided to an individual in the two years after diagnosis of either bladder cancer, uterine cancer or melanoma of the skin is 2,345.8 hours (Yabroff and Kim 2009); and
- all individuals with advanced melanoma require informal care.

The overall cost of informal care associated with advanced melanoma is estimated to be $24.2 million in 2014. The distribution of costs between age groups and gender is shown in Table 11.
4.5 Disability Adjusted Life Years

Advanced melanoma results in a loss of the quality and length of individuals’ lives. The prevalence and severity of advanced melanoma determines the degree to which the disease reduces the stock of health capital.

The most commonly used measure of the burden of disease is the disability adjusted life year (DALY). DALYs are a measure of the degree to which a disability burdens an individual. They are measured by the number of healthy life years lost due to a disability. DALYs are comprised of two components: the number of healthy years lost due to premature mortality (YLLs) and the number of years of healthy years lost due to disability (YLDs).

Table 11: Cost of informal care by age group and gender

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males ($ '000)</th>
<th>Females ($ '000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>2.3</td>
<td>-</td>
</tr>
<tr>
<td>5-9</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>10-14</td>
<td>6.5</td>
<td>1.3</td>
</tr>
<tr>
<td>15–19</td>
<td>22.9</td>
<td>19.4</td>
</tr>
<tr>
<td>20–24</td>
<td>79.2</td>
<td>118.8</td>
</tr>
<tr>
<td>25–29</td>
<td>150.2</td>
<td>244.8</td>
</tr>
<tr>
<td>30–34</td>
<td>278.3</td>
<td>312.1</td>
</tr>
<tr>
<td>35–39</td>
<td>440.2</td>
<td>475.9</td>
</tr>
<tr>
<td>40–44</td>
<td>507.5</td>
<td>603.6</td>
</tr>
<tr>
<td>45–49</td>
<td>761.4</td>
<td>846.7</td>
</tr>
<tr>
<td>50-54</td>
<td>1,128.6</td>
<td>875.3</td>
</tr>
<tr>
<td>55-59</td>
<td>1,528.5</td>
<td>1,093.2</td>
</tr>
<tr>
<td>60-64</td>
<td>1,913.3</td>
<td>1,167.2</td>
</tr>
<tr>
<td>65-69</td>
<td>1,817.1</td>
<td>960.0</td>
</tr>
<tr>
<td>70–74</td>
<td>1,570.7</td>
<td>763.5</td>
</tr>
<tr>
<td>75–79</td>
<td>1,544.0</td>
<td>785.7</td>
</tr>
<tr>
<td>80–84</td>
<td>1,494.6</td>
<td>778.1</td>
</tr>
<tr>
<td>85+</td>
<td>1,101.7</td>
<td>799.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,338.3</strong></td>
<td><strong>9,843.5</strong></td>
</tr>
</tbody>
</table>

Source: KPMG calculations.
Each disease has a DALY weight that is measured on a scale of zero to one, where zero represents no life lost (i.e. a healthy year of life) and one represents death. For example, a disease with a DALY weight of .50 indicates that a person living with that disease loses half of their quality of life compared to perfect health.\(^7\)

Where the duration of the condition is lifelong or the person is expected to die before the condition is resolved, the duration of condition is determined by the number of years between diagnosis and expected death. For example, if a healthy 93 year old female is expected have 4 years of life left, and a 93 year old female is diagnosed with a condition with a typical duration of 10 years, the duration is capped at 4 years.

The total disability adjusted life years lost in 2014 is 25,875. Years of life lost is greatest for individuals between 55 and 69 years old for both men and women, while the greatest burden of disease is for males. Both of these reflect the distribution of advanced melanoma incidence.

**Figure 4: Distribution of DALYs by gender and age group**

![Figure 4: Distribution of DALYs by gender and age group](image)

*Source: KPMG calculations.*

\(^7\) YLDs=Incidence of condition x duration of condition x DALY weight
5 Conclusion

Australians love the great outdoors. Whether we are at the beach, watching the cricket, walking through bushland, or going fishing, our sunny skies make the Australian lifestyle one of the most envied in the world. However, our outdoor lifestyle, coupled with predominantly Caucasian skin and a high UV index, contributes to the relatively high incidence of melanoma.

This report has shown that advanced melanoma imposes a significant financial burden on government and society (primarily through lost productivity, increased health care costs, research and informal care). The total cost was estimated to be $422 million in 2014.

Yet the greatest burden is on the patient, family and friends. For those diagnosed with advanced melanoma they may need to contend with their own mortality, as well as manage a raft of physical and emotional side effects associated with the disease itself and the treatment regime. Families and friends experience grief, changing roles within the family, potentially a large financial burden, depression and anxiety.

While the treatments for advanced melanoma have historically been limited and relatively ineffective, many new therapies are being developed and trialled. Emerging therapies are not always easily accessible for all patients in Australia.

Governments have also invested in prevention and awareness campaigns. Ongoing investment in prevention and early detection is likely to maintain or reduce incidence over time, thereby reducing the costs associated with advanced melanoma, given the significantly reduced costs associated with diagnosis in the early stages of the disease.

This suggests continued focus on public awareness, screening, improving access to cost effective treatments for advanced melanoma, and supporting research to develop new treatments is a worthwhile strategy to improve outcomes for patients and government.
6 References


Swerissen H and Duckett S 2014, Dying well, Grattan Institute,


World health Organisation 2014, Ultraviolet radiation and the INTERSUN Programme,

A Scope and costing methodology

This appendix provides an outline of the project scope and the methodology used to estimate cost, including:

- A.2 Health care and research costs
- A.3 Productivity loss
- A.4 The cost of informal care.

A.1 Project scope

The scope of this project was to provide an independent analysis of the financial and non-financial impact of advanced (stages III and IV) melanoma on patients, carers, families and the community.8 The following tasks have been undertaken.

- Estimated the incidence and prevalence of melanoma and metastatic melanoma in Australia
- Highlighted the survival rate of melanoma and metastatic melanoma, and the estimated mortality associated with both.
- Outlined the treatment regime for advanced melanoma patients, highlighting the psychosocial impacts of undergoing treatment, and the ongoing care, management and treatment required for melanoma patients in the post-treatment phase.
- Estimated the cost associated with treating advanced stage melanoma, including an analysis of the different types of cost (i.e., health costs, research productivity impacts, informal care costs, and deadweight loss) and the groups impacted (i.e., patients, carers, community, government).
- Explored existing, novel and emerging therapies to achieve better outcomes for advanced stage melanoma patients.

This project has used publically available information to assess the impact of advanced melanoma. Both references and the methodology used to derived estimates are described throughout this report.

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8 This does not include estimating the impacts of comorbidities associated with advanced melanoma, such as anxiety and depression.
A.2 Health care and research costs

The Australian Institute of Health and Welfare (AIHW) collects information on the cost of cancer, including the cost of melanoma (early and advanced stages). Although this data was relied upon to estimate the cost of advanced melanoma, two significant adjustments were made to calculate the cost of advanced melanoma. They included:

- removing the cost of early stage melanoma from the total cost of melanoma by undertaking a ‘bottom up’ costing approach; and
- estimating additional costs associated with pharmaceutical treatments for advanced melanoma that have been introduced since AIHW’s estimate of the cost of melanoma.

A description of health care cost components include in AIHW’s estimated cost of melanoma, and the methodology use for each adjustment are presented below.

A.2.1 The cost of melanoma

The cost of melanoma was estimated to be $49.5 million in 2008-09 (AIHW 2014a). Health care costs measured by AIHW relate to the cost associated with treatment and include:

- Admitted patient hospital costs, which includes services for admitted patients in both public and private acute hospitals.
- Out-of-hospital medical expenses, which includes services provided by, or on behalf of, registered medical practitioners (e.g., general practitioners and specialists).
- Non-MBS medical services, which includes expenditure by the Commonwealth Government under funding arrangements that are alternatives to fees for service.
- Prescription pharmaceuticals, which includes pharmaceuticals listed on the Pharmaceutical Benefits Scheme (PBS) and the Repatriation Pharmaceutical Benefits Scheme (RPBS). Also includes co-payment costs and costs for private prescriptions (AIHW 2014c).

There are some limitations with costs presented in the Disease Expenditure Database. It only captures around 70 per cent of the total recurrent health care costs, and does not allocate all expenditure across disease. Furthermore, there has been an increase in the price of health care and incidence of advanced melanoma since 2008-09. To ensure cost estimates reflect these increased costs, three adjustments were made to AIHW’s estimated cost of melanoma. They included:

- multiplying the total cost estimate by 1.4 to capture the 30 per cent of total recurrent health care costs not included in the estimate;
- multiplying the total cost estimate by health care inflation since 2008-09; and
- multiplying the total cost estimate by the growth rate in incidence since 2008-09.

The cost of health care (as above) associated with melanoma was estimated to be $86.1 million in 2014 based on these adjustments. Further steps were then taken to exclude the costs of early stage melanoma (see section A.2.2) and to estimate the additional costs associated with melanoma.

A.2.2 Removing the cost of early stage melanoma

The total cost of melanoma includes the cost associated with early and advanced stage melanoma. To estimate the cost of advanced melanoma, the cost of early stage melanoma was removed from the total cost.
The cost associated with early stage melanoma was estimated using a ‘bottom up’ costing approach. Estimated incidence of early stage melanoma was applied to an assumed treatment path and health care unit costs. The treatment path was assumed to consist of:

- an initial consultation with a GP, specialist or cancer clinic;
- excision of the melanoma, with associated pathology testing; and
- a follow up consultation with a GP, specialist or cancer clinic within a year.

The proportion of consultations and excisions undertaken by GPs, dermatologists, surgeons was informed through information collected from the Bettering the Evaluation and Care of Heath (BEACH) survey and the National Cancer Control Initiative (NCCI) surveys. The costs associated with services was informed through the Medicare Benefits Schedule (MBS) and Pathology Services Table (PST).

A.2.3 Accounting for the cost of new treatments

Since 2008-09 there has been a large scale change in the treatment of advanced melanoma. In particular, Ipilimumab was introduced in July 2013 with an announcement by the government that it would provide $430 million over the next four years to subsidise treatment (for this and two other cancer drugs). In addition, Dabrafenib was introduced in November 2013, which is also expected to create a significant cost.

The cost of these pharmaceuticals is estimated to be $94.7 million in 2014 based on wholesale expenditure data. This is presented by pharmaceutical type and month in Table A 1. In addition, there is a cost associated with testing tumour tissue from a patient with unresectable stage III or stage IV metastatic cutaneous melanoma to determine if the requirements relating to BRAF V600 mutation status for access to Dabrafenib. The cost for each test was sourced from the Pathology Services Table (item 73336) and multiplied by the actual and projected volume of Dabrafenib for 2014, resulting in an estimated cost of $833,000.

To ensure the total health care cost of advanced melanoma included these pharmaceuticals, estimated total expenditure for both Iplimumab and Dabrafenib in 2014 were added onto the total adjusted cost estimate for advanced melanoma derived from the AIHW.

However, these pharmaceuticals represent an alternative treatment for people with stage IV melanoma and are now replacing chemotherapy. Therefore the cost of chemotherapy in 2014 was estimated and subtracted from the total to provide a net cost of new treatment. This was achieved by reducing the estimated cost of advanced melanoma by 11.9 per cent (before adding the cost of new treatments), which represents the proportion of the cost of pharmaceuticals relative to the total cost of cancer in 2008-09 (AIHW 2013).
### Table A 1: Actual and projected cost of new pharmaceutical treatments, 2014

<table>
<thead>
<tr>
<th>Month</th>
<th>Ipilimumab</th>
<th>Dabrafenib</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>3,253.7</td>
<td>1,573.6</td>
<td>4,827.3</td>
</tr>
<tr>
<td>February</td>
<td>3,926.0</td>
<td>1,737.0</td>
<td>5,663.0</td>
</tr>
<tr>
<td>March</td>
<td>5,465.9</td>
<td>2,502.6</td>
<td>7,968.5</td>
</tr>
<tr>
<td>April</td>
<td>6,169.8</td>
<td>2,583.8</td>
<td>8,753.6</td>
</tr>
<tr>
<td>May</td>
<td>5,603.6</td>
<td>2,878.6</td>
<td>8,482.2</td>
</tr>
<tr>
<td>June</td>
<td>5,563.8</td>
<td>2,743.0</td>
<td>8,306.7</td>
</tr>
<tr>
<td>July</td>
<td>5,779.1</td>
<td>2,735.1</td>
<td>8,514.2</td>
</tr>
<tr>
<td>August</td>
<td>5,648.8</td>
<td>2,785.5</td>
<td>8,434.4</td>
</tr>
<tr>
<td>September</td>
<td>5,663.9</td>
<td>2,754.5</td>
<td>8,418.4</td>
</tr>
<tr>
<td>October</td>
<td>5,697.2</td>
<td>2,758.4</td>
<td>8,455.6</td>
</tr>
<tr>
<td>November</td>
<td>5,670.0</td>
<td>2,766.2</td>
<td>8,436.1</td>
</tr>
<tr>
<td>December</td>
<td>5,677.0</td>
<td>2,759.7</td>
<td>8,436.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>64,118.7</strong></td>
<td><strong>30,578.0</strong></td>
<td><strong>94,696.7</strong></td>
</tr>
</tbody>
</table>

*Note: Data for January to June is actual sales data, while data for July to December has been estimated using a three month rolling average.*

*Source: IMS Health and KPMG calculations.*

### A.2.4 Research costs

There are also research costs associated with advanced melanoma. Cancer Australia (2014) found direct funding to cancer research projects and research programs has more than doubled, from $292 million to $596 million between 2003-05 and 2009-11.

Of this, the proportional funding to skin cancer was around 10 per cent, which has been consistent since 2003-05. The total funding to melanoma research projects and research programs increased from $8.5 million (2003-05) to $24.6 million (2009-11).

However, not all this funding was allocated to treatment. Over the period 2009-11, around 47 per cent was allocated to early detection, diagnosis and prognosis, with biology representing 21 per cent and the remaining allocated to treatment for advanced stage melanoma. This equates to $7.8 million, or approximately $2.6 million each year.

### A.3 Productivity loss

Advanced melanoma results in a reduction in labour market participation as a result of absenteeism, premature retirement and premature mortality. A human capital approach was used to estimate lost productivity. This approach assumes that the Australian economy is at full employment, such that any labour market non-participation due to forced retirement or
mortality cannot be replaced by increasing the hours of other workers (underemployment) or employing another worker (unemployment).

The value of lost productivity was measured as the present value of gross earnings that an individual would have earned had they not developed advanced melanoma. The likelihood of being in paid employment, and the income drawn from this employment is taken into consideration. Productivity loss is estimated separately for males and females, reflecting the different profile of employment and earning capacity.

A.3.1 Probability of being employed over a lifetime

Data from the Australian Bureau of Statistics was used to estimate the probability of a person being employed at a given age group. Employment rate was chosen as a measure of the probability of being employed over a lifetime. Despite minor fluctuations in the employment rate over the past 10 years, they are not expected to have a material effect on the analysis. Therefore, the most recent employment rates were used for each gender and age group.

It was assumed that June 2013 employment rates would remain consistent in the future. This means that the probability of a 40 year old male being employed today is the same as the probability of a 15 year old male being employed in 25 years.

A.3.2 Income from employment

Gross earnings that an individual would have earned in their remaining lifetime were estimated using ABS data on the average weekly earnings for males and females by age group. These data were project over time and capped at the retirement age of 65.

Real income was expected to increase over time in line with labour productivity. Labour productivity was measured as output per hour worked. Over the past 33 years this has varied between -2.1 and 3.6 per cent with an average of 1.5 per cent (Eslake 2011). The average productivity is used to account for cyclical and structural variations in labour productivity over time.

A.3.3 Reduced labour market participation

Temporary absenteeism

Temporary absenteeism due to melanoma is difficult to quantify given the divergent treatment pathways for advanced melanomas with different sites of metastases. According to Short et al (2005), cancer survivors are absent from work for an average of 201.8 days. Given that advanced melanoma can result in a many types of secondary cancers, the average

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9 A discount rate of 7 per cent was used based on Office of Best Practice Regulation (OBPR) recommendations.

10 The employment rate is a better measure of the probability of being employed over a lifetime rather than the unemployment rate. This is because the unemployment rate excludes people who are not employed, but are not actively seeking employment.

11 The most recent data relate to June 2013.

12 This includes income that is drawn from full time and/or part-time employment.

13 This is the full period for which the relevant data (chain-volume GDP and hours worked) are available in a consistent format.
absenteeism for all cancers is considered a proxy for the average absenteeism for all melanoma disease progressions.

The cost of temporary absenteeism was calculated by multiplying the incidence of advanced melanoma, the average time off work for treatment and care, the probability of being employed, and the average wage. This value was then indexed by the likelihood of individuals being in employment, as measured by the employment rate, and a ceiling as was applied at age 65.

### Premature retirement

Premature retirement consists of individuals who survive after advanced melanoma but do not return the workforce.

Data on the proportion of people with advanced melanoma returning to work is limited. According to Short et al (2005), the proportion of all cancer survivors that return to work is 84 per cent. Therefore, the inverse of this proportion multiplied by the incidence of advanced melanoma was taken as an index of labour market non-participation due to premature retirement.

### Premature death

The number of deaths due to advanced melanoma was sourced from the AIHW Australia Cancer Incidence and Mortality (ACIM) books. The most current mortality of melanoma data were forecasted to 2014 using the average yearly increase over the period of 2000-2010.

### A.4 Informal care

The opportunity cost method was used to estimate the monetary value of informal care. This method is based on the assumption that the value of time spent providing informal care is equal to the value of the carer’s time in the workforce.

The average number of hours of informal care provided to an individual in the two years after diagnosis of either bladder cancer, uterine cancer or melanoma of the skin is 2,345.8 hours (Yabroff and Kim, 2009).

As such, the value of informal care was calculated by multiplying average weekly earnings sourced from the ABS by the estimated incidence of advanced melanoma and the average number of hours of informal care provided to an individual.