

Economic benefits of MedicAlert identification

Research and survey results

*Report for
MedicAlert
Foundation*

February 2018

pwc

Private & Confidential

Murray Lord
CEO
MedicAlert Foundation
PO Box 40028
Upper Hutt 5140

13 February 2018

Dear Murray

In accordance with our engagement letter dated 19 August 2016, we are pleased to provide our final report on the impact of MedicAlert.

The scope of our work on this engagement was to estimate the value of using a MedicAlert ID.

This report has been prepared in accordance with the terms and conditions set out in our engagement letter dated 19 August 2016 and should be read in conjunction with the key terms of business and restrictions and disclaimers included in that document, as well as the disclaimers and assumptions noted in Appendix A of this report.

If you require any clarification or further information, please do not hesitate to contact us.

Yours sincerely



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Executive summary

MedicAlert currently produces benefit for members

MedicAlert identification improves members' lives in several ways. One benefit comes from avoiding harm, particularly from avoiding allergic reactions. Members also report that their identifications reduce the number of medical tests they need and reduce the time they spend in treatment. Together, reduced harm and more efficient treatment account for \$38 million of benefits per year for existing members.

Members also report increased wellbeing. Wellbeing benefits arise because members have confidence that they are receiving the right treatment, and because they have peace of mind while they are out in the community. We have not put a dollar value on these benefits.

MedicAlert also produces system-level benefits

The use of MedicAlert leads to efficiencies in medical treatment and less harm. These impacts have an economic value for the healthcare system.

We have estimated that healthcare efficiencies create benefits of \$2.6 million annually across the current MedicAlert membership. Avoided harm contributes an additional \$15.5 million of benefit annually. The total benefit to the healthcare system of current MedicAlert use is therefore estimated at \$18.1 million per year.

In total, we estimate a benefit-cost ratio (BCR) of about 11 to 1.

There are considerable potential benefits for New Zealand

There appears to be scope to increase the reach of MedicAlert. Currently, only 2.06% of the NZ population have registered MedicAlert identifications, yet 22% of the population have at least one of the four main reasons to have one (allergy, heart disease, respiratory disease, diabetes).

The potential value depends on the level of improvement that could be achieved by using MedicAlert. We have estimated the national potential value of reduced harm at between \$102 million and \$242 million per year.

The precise amounts can be challenged, but the main message holds

To calculate these benefits, we have relied on:

- MedicAlert database of **91,806** and survey responses from **4,148** members.
- Findings from published, peer-reviewed studies of issues and impacts in the New Zealand healthcare system
- Cost data and usage data from public sources, such as The Treasury
- Specific assumptions about impacts and improvements.

The exact dollar amounts reported are a result of the data and assumptions. If the input figures are changed then the estimated impacts also change. However, the exact estimates are less important than the message they convey: MedicAlert produces significant public and private benefits for members and the healthcare system, and more could be achieved.

February 2018

What is the reason for these impacts?

MedicAlert helps to solve a known problem with medical care

Internationally published, peer-reviewed research has shown that errors occur with medical treatment and that these errors produce avoidable harm to patients.

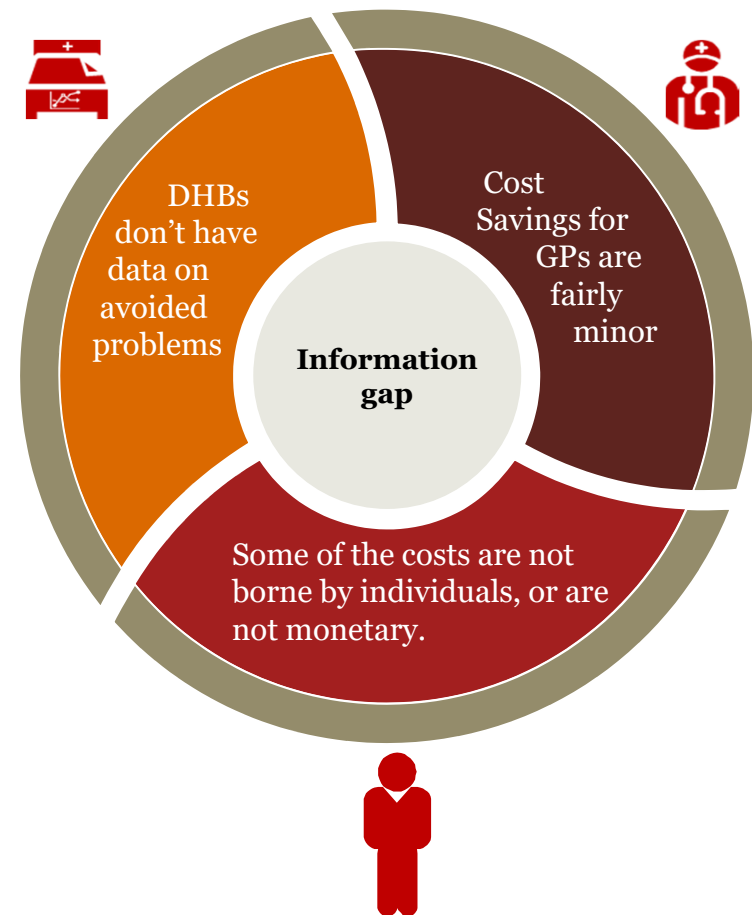
MedicAlert identification, backed by the organisation's database of members and appropriate healthcare protocols, provides a solution.

Economic theory can account for the high benefit-cost ratio

The estimate BCR of 11 to 1 is high for a healthcare intervention. The high BCR can be explained as a problem of *information* and *incentives*.

- **Information** – The extent of harm from errors is not known with certainty. Also, the harm that is avoided through the use of MedicAlert is unknown: no one tracks the occasions when someone checked a MedicAlert identification and did not administer the wrong treatment.
- **Incentives** – Individuals have a lot to gain from avoiding harm, but they do not pay the full cost of the additional medical care. DHBs bear the costs of the additional treatment, but not the private costs of lost wages, out-of-pocket expense and patient deaths. GPs have some additional costs, but they are probably not enough to warrant attention in the context of a busy practice.

No one person has the information and incentive to consider the full extent of the problem. MedicAlert is an inexpensive solution to the information problem for a specific group of people, producing a outsized gain.



Section 1

Framework of the impact assessment

Overview of MedicAlert benefits

We can better understand the benefits of MedicAlert by dividing them up in different ways.

Sources of benefits

MedicAlert can produce improvements in personal wellbeing and medical care. There are three main sources of benefits.

- 1. Efficiency** – because of the information on the identification and in the MedicAlert database, members receive faster care and have fewer medical tests. For each person, the efficiency gain is small, but it adds up across all the members and their care.
- 2. Avoided harm** – MedicAlert identification signals to other people – medical staff and bystanders – that a member has a known medical issue. Particularly in the case of known allergies, MedicAlert helps members avoid harm from incorrect medical treatment.
- 3. Wellbeing** – Because MedicAlert identification alerts bystanders to medical issues, members feel safer and more confident being out in the community. They have peace of mind that, should something happen, they can receive the right care.

Who receives the benefits

The benefits can be divided into public benefits and private benefits.

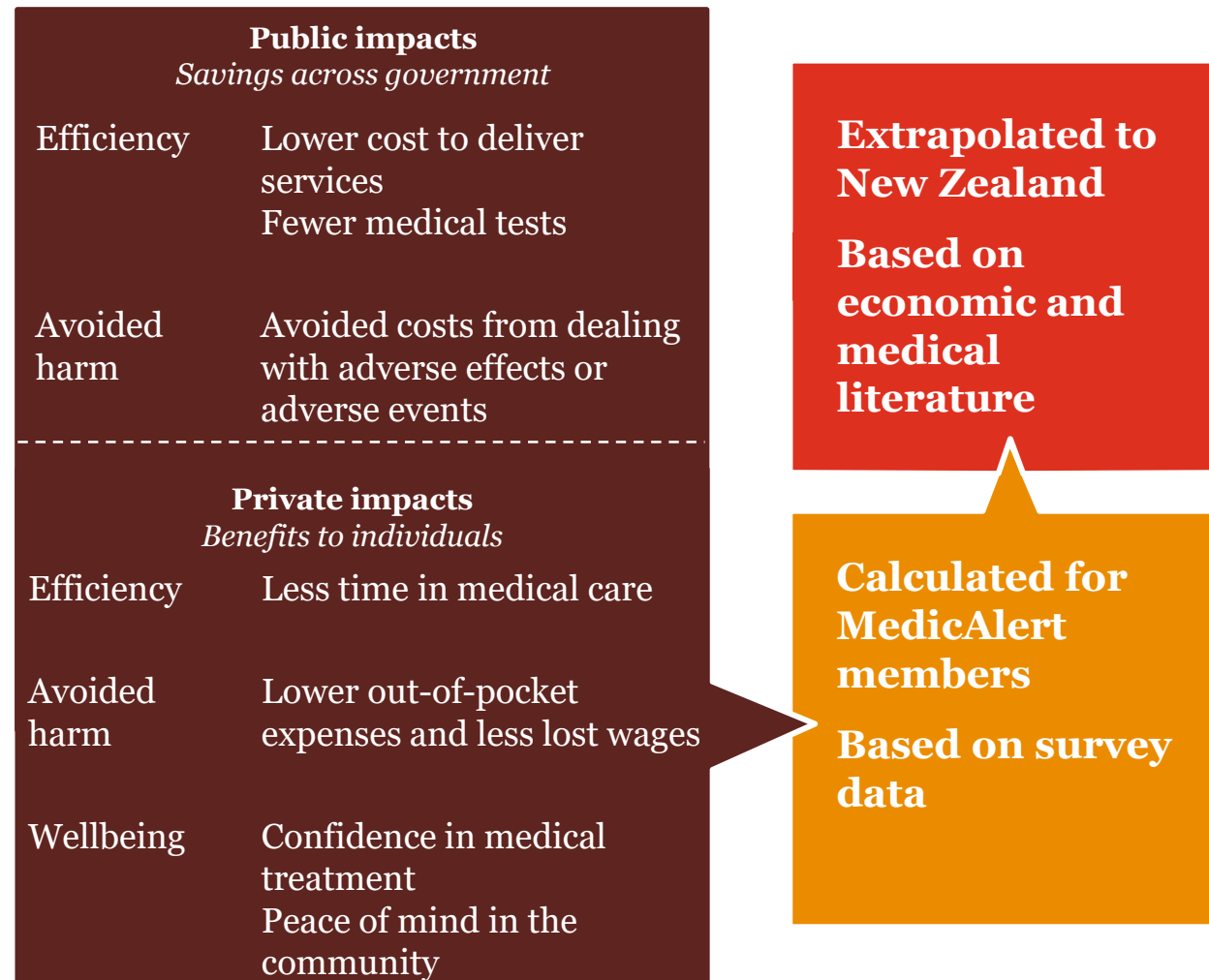
- 1. Public** – some benefits come from reduced public costs – lower government spending. Through efficiency gains and avoided harm, MedicAlert identification reduces medical expenses and other public cost. Principally, public benefits occur with hospitals, doctors' offices, emergency services, and the like. They also arise from lower ACC costs and lower welfare payments.
- 2. Private** – some benefits mainly help individual members. Healthcare issues create personal costs, such as out-of-pocket expenses and lost wages. When members receive better, faster medical treatment or avoid harm, they have lower personal costs.

Certainty of benefits

We can be confident of some of the benefits produced. We can also use that information to estimate potential benefits.

- 1. Delivered benefits** – MedicAlert members say that they benefit from having the identification. They report that they have experienced times when their identifications were checked, and they were better off as a result. Using survey data, we can estimate the benefits actually delivered by the current use of MedicAlert identifications.
- 2. Potential benefits** – There are likely to be other New Zealanders who could benefit from MedicAlert identifications. It is possible to use existing literature and survey data to estimate the potential benefits to New Zealand from expanding the MedicAlert programme.

Framework for estimating MedicAlert benefits Alternative 1e



Section 2

Avoided harm – the scale of the issue

How much harm could be avoided?

The biggest impact of MedicAlert comes from avoiding harm

Research suggests that problems frequently happen with medical treatment. Some of the harm cannot be helped: people don't know they are allergic to a medicine until the first time they have an allergic reaction; side effects occur with medicines and need to be managed; people make mistakes in prescribing or administering medicine.

The scale of the issue means two things:

- MedicAlert members report that they avoid problems relatively frequently
- The economic benefit of making improvements to the rate of ADEs is potentially large.

One area that has been studied in New Zealand and overseas is adverse drug events and their prevention. Some of the literature is summarised on the next pages, and more references are provided in the appendix.

The case of Eunice Richardson

Eunice Richardson was an individual who wore a MedicAlert bracelet stating her severe allergy to trimethoprim.

During 2013, she was admitted to hospital. Whilst in hospital her MedicAlert bracelet was not checked and the hospital systems put in place to alert medical practitioners to her allergies were ignored. The coroner's findings revealed she was wrongly administered trimethoprim and suffered a severe allergic reaction.

Eunice was then admitted to intensive care in Christchurch Hospital with toxic epidermal necrolysis, and died a few days later.

Key recommendations are to:

- **Develop a policy requiring the routine checking of MedicAlert bracelets**
- **Invest in technological solutions that automatically link MedicAlert information to patient management systems.**

Adverse drug events in New Zealand – a literature review

Davis et al (2001), Adverse events in New Zealand public hospitals: principal findings from a national survey

A retrospective study of 6,579 medical records was undertaken, identifying 850 adverse events. Adverse events occurred in 12.9% of admissions. Of these, 37% were determined to have not been preventable, with 63% having some degree of preventability.

“The study provides the base parameters necessary to inform our understanding of patient safety and quality of care in New Zealand public hospitals”

Brown et al (2002), Cost of Medical Injury in New Zealand: A retrospective cohort study

This study follows on from Davis (2001), estimating the cost of adverse events on the medical system. The estimated costs were based on prices charged to international patients. The cost of these adverse events ranged depending on severity, with an average of \$10,264. Overall the cost to the medical system was over \$870 million. Preventable adverse events were more costly than those that weren't preventable, with over \$590 million of this attributable to them.

“Adverse events are a significant drain of healthcare resources in New Zealand. These findings suggest that substantial resources could be saved from eliminating preventable adverse events.”

Robb et al (2017), Medication-related patient harm in New Zealand hospitals

More recently, a similar study was conducted using Adverse Drug Event (ADE) data from 2013-2015. 2,659 records were examined and 923 medication-related harms were identified within 751 patients. Therefore, 28% of patients experienced one or more harms. These harms were put into categories based on severity. These varied from temporary harm requiring intervention to patient death.

“This paper confirms earlier work that medication-related harms are common, occur both in hospitals and in the community, and are a substantial burden for patients and our healthcare system.”

Adverse drug events internationally – a literature review

Lövborg et al (2012), A prospective analysis of the preventability of adverse drug reactions reported in Sweden

The study analysed 1,290 reports of adverse drug reactions (ADRs) and found that 14% were preventable. Over half the preventable ADRs related to how the drugs were prescribed, while drug administration and monitoring of treatment were less important.

“Most [preventable ADRs] are related to drug prescription, suggesting that interventions aiming to reduce preventable ADRs should focus on this process.”

Hakkarainen et al (2012), Percentage of Patients with Preventable Adverse Drug Reactions and Preventability of Adverse Drug Reactions –A Meta-Analysis.

This research conducted a meta-analysis of 16 studies on outpatients and 8 studies on inpatients. ADRs affected 1.2% to 3.2% of outpatients and 0.1% to 51% of inpatients, a wide range. Roughly one-half of ADRs were preventable (42%–62% for outpatients, 33%–58% for inpatients).

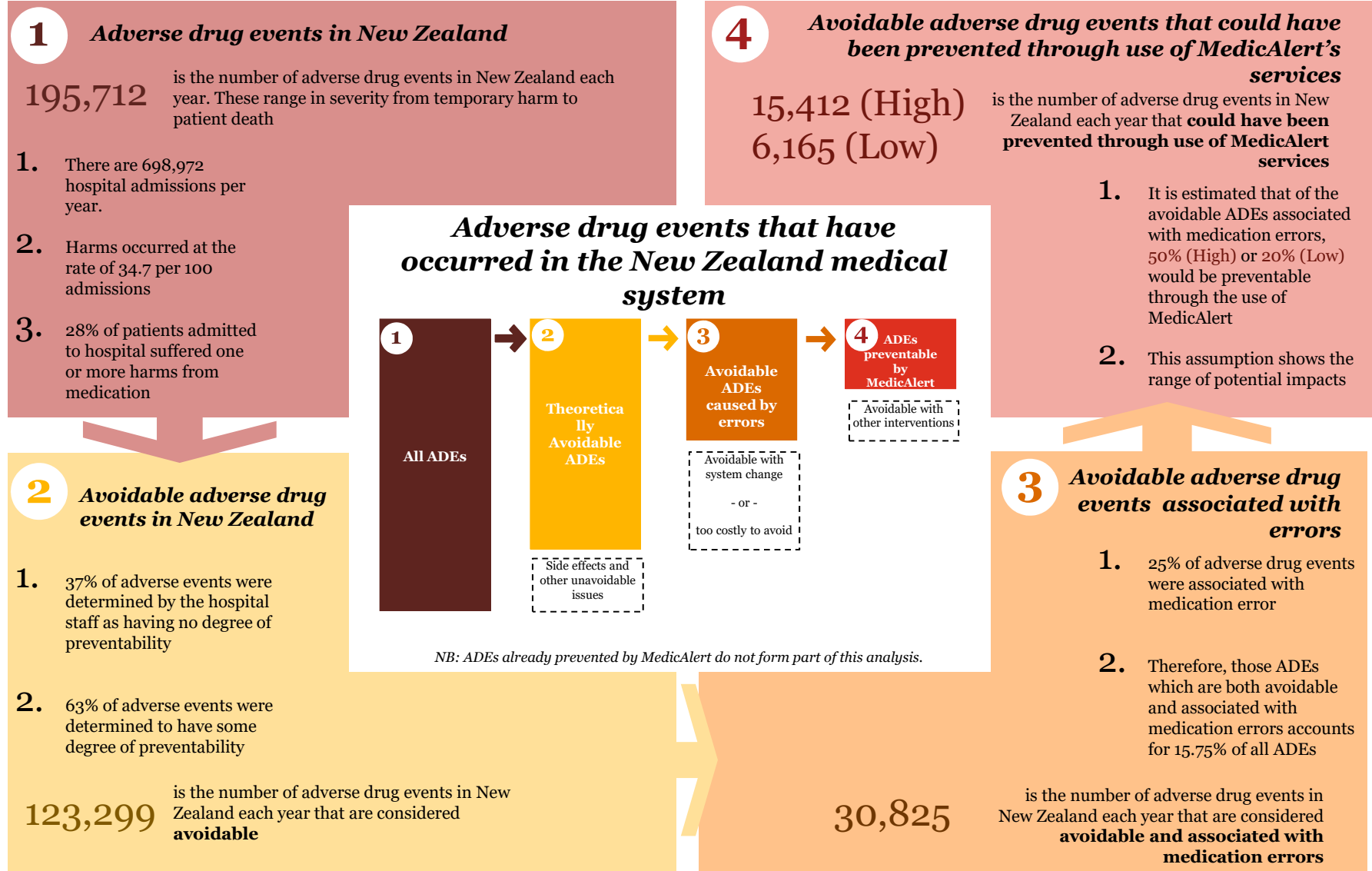
“This meta-analysis demonstrates that PADR are a significant cause of morbidity among outpatients and that roughly half of all ADRs among adult outpatients and inpatients may be prevented.”

Bates et al (1995), Incidence of Adverse Drug Events and Potential Adverse Drug Events: Implications for Prevention

This older study reviewed a random sample of admissions in the US. They found 6.5 ADEs and 5.5 potential ADEs per 100 admissions. Twelve percent were life-threatening, while 30% were serious; 42% of ADEs in those two categories were preventable.

“Adverse drug events were common and often preventable; serious ADEs were more likely to be preventable.”

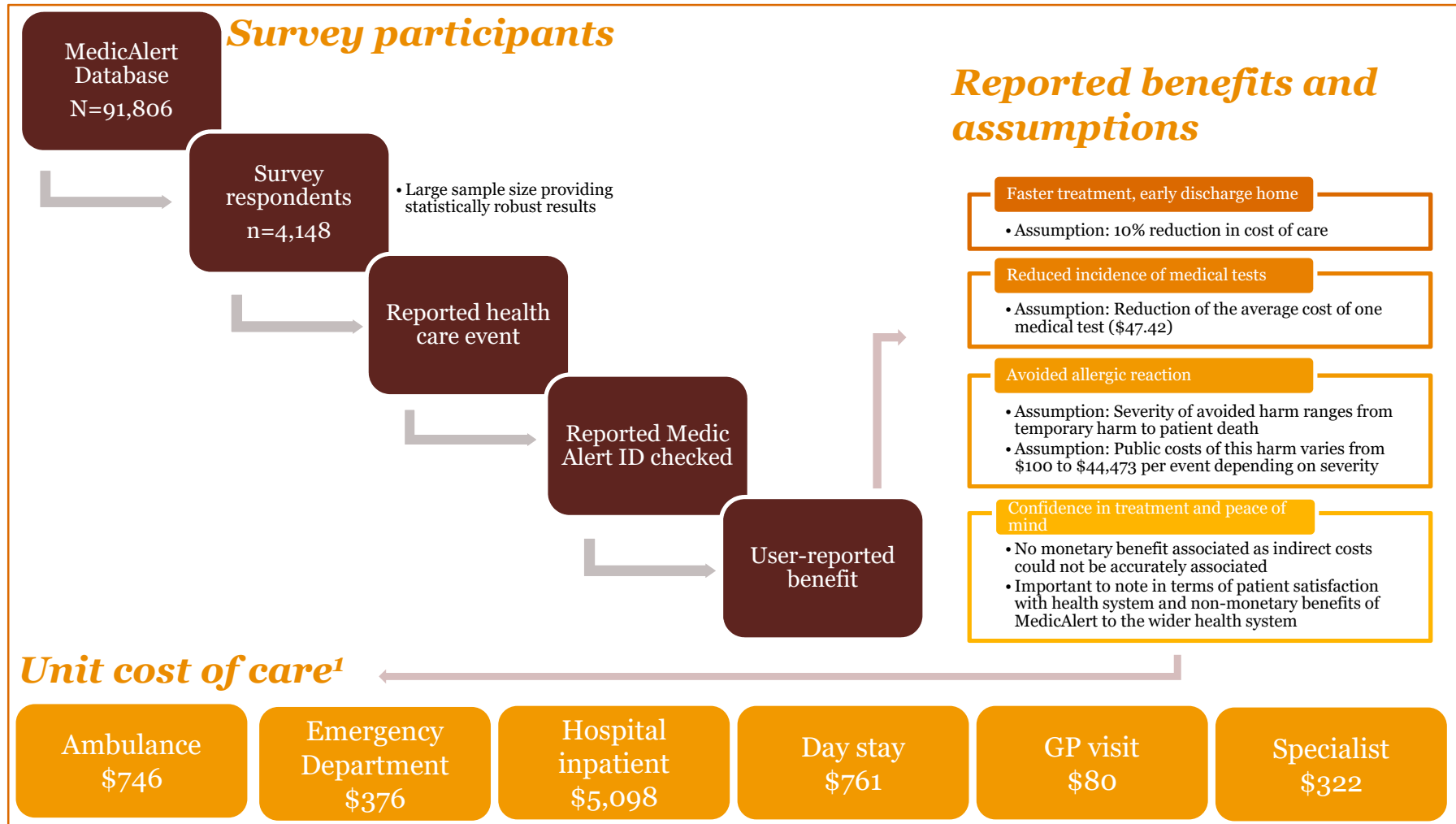
Potential national impact: prevention of adverse drug events



Section 3

Survey of MedicAlert members

Survey methodology



(1). Source: <http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax>



Profile of MedicAlert survey respondents

11.8 years of membership

>68% of members have been using MA 5 years or more

57.3 years old

>57% of MA members are 60 years of age or older

68% Women



Conditions

1. Allergy

2. Heart diseases

3. Diabetes

4. Respiratory diseases (incl. Asthma)

>91% of the MA members survey respondents have at least one of the above conditions.

Data was collected on user's interactions with the following Healthcare services:



Ambulance



Emergency Department



Overnight hospital stays



Day stay at a medical facility



GP

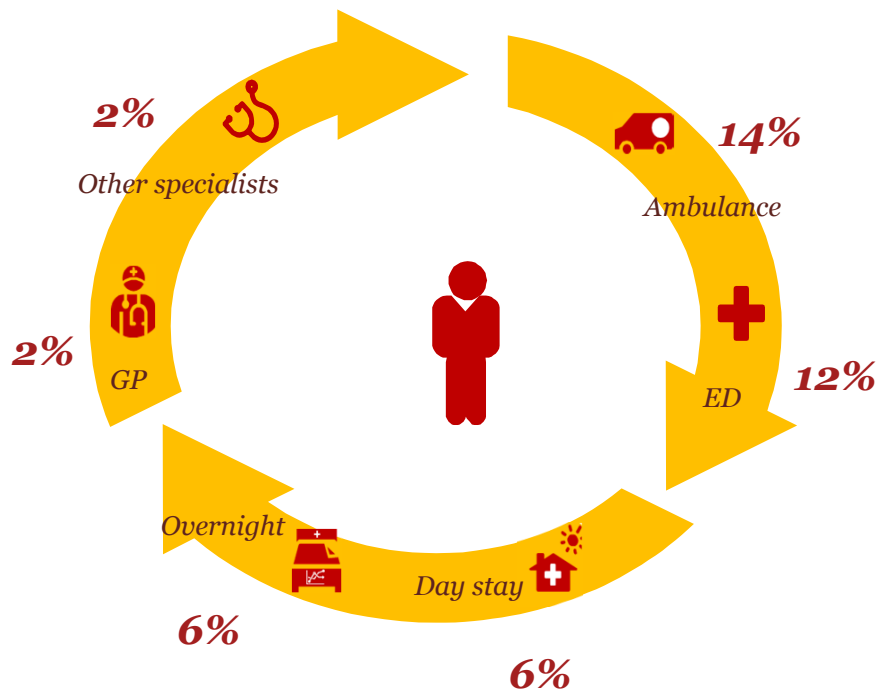


Other specialists

Survey results: efficiency

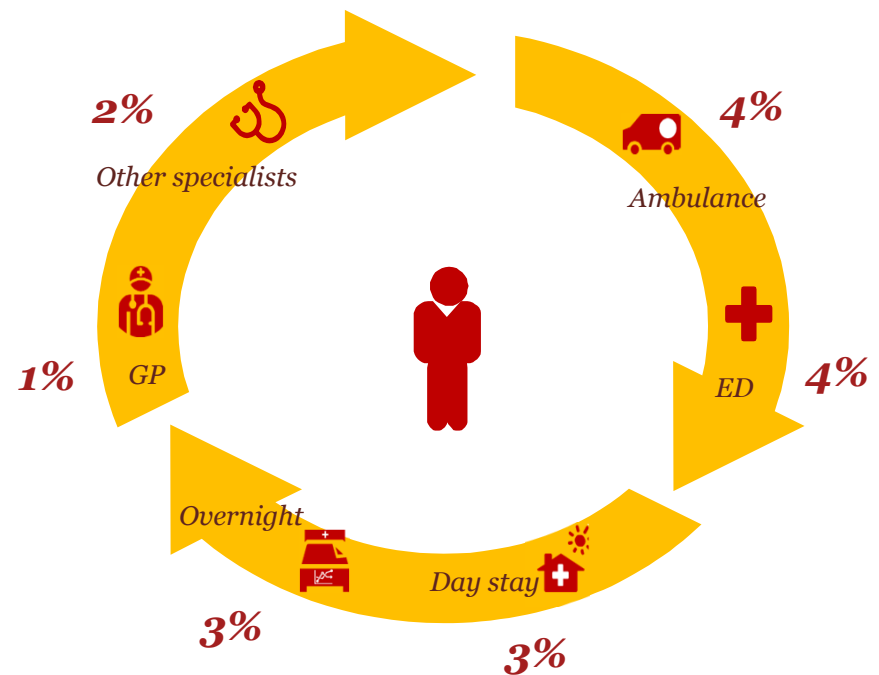
Those who stated “my treatment was faster”:

Of those people whose MedicAlert ID was checked, respondents identified experiencing faster treatment. The percentage varied by healthcare services



Those who stated “I had fewer tests”:

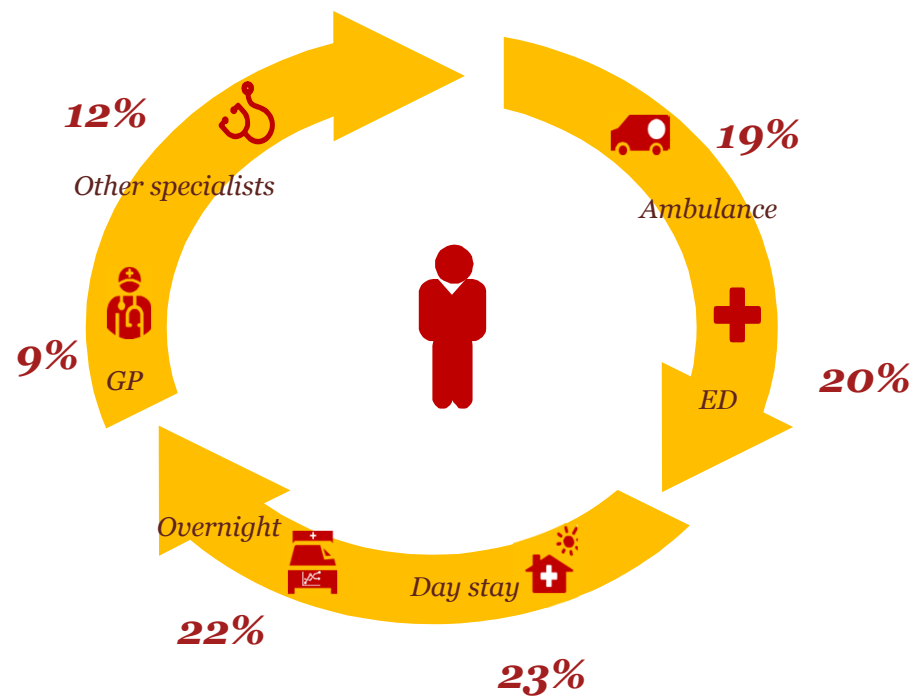
Of those people who have a MedicAlert ID checked, between 2% to 4% of respondents have identified experiencing fewer medical tests.



Survey results: avoided harm

Those who avoided an allergic reaction

Of those who had their MedicAlert ID checked, respondents identified that this led to a reduction in the likelihood of harm from receiving the wrong treatment.

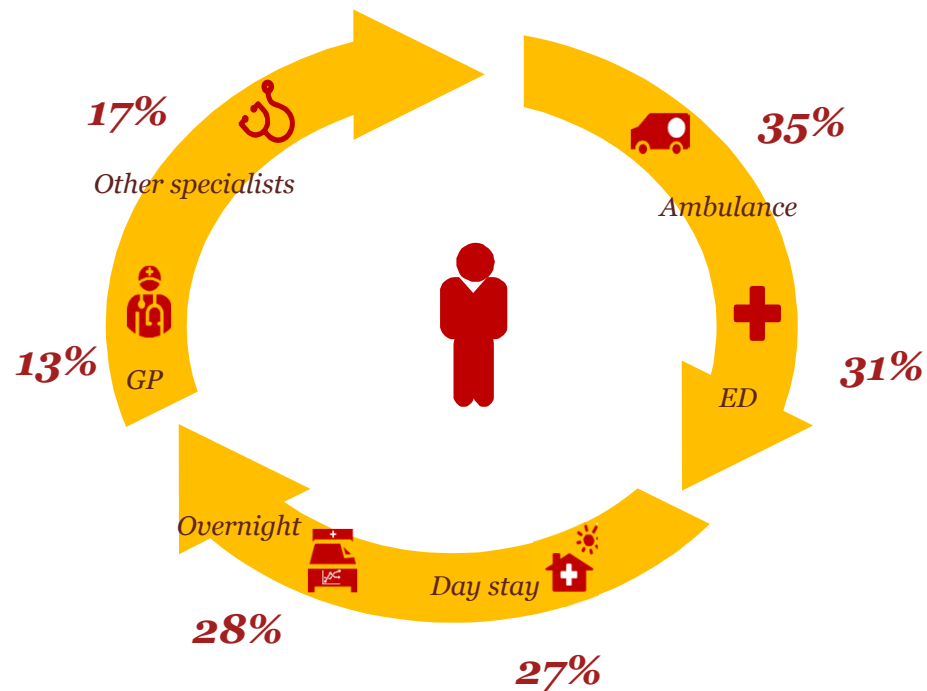


The literature makes it clear that Adverse Drug Events do occur. Although the avoided ADEs reported by respondents appears to be high, the literature suggests it is not out of the ordinary.

Survey results: wellbeing

Respondents report increased confidence in receiving correct treatment

Because of the MedicAlert ID patients “had more confidence that they were getting the right treatment”. Again, this varied by healthcare service.



MedicAlert provides a real benefit to its users. Although we have not assigned a dollar value to the increased confidence in receiving the correct treatment because of the MedicAlert ID, it remains a large contributor to consumer confidence. Other people have assigned a value to the benefits of this service and further analysis could extract this value

Section 3

Delivered benefits, MedicAlert members

Summary of delivered benefits

Delivered benefits

In our framework, we separate delivered benefits from potential benefits. This section focuses on benefits that are currently being produced and delivered in New Zealand for the current membership of MedicAlert.

- **Efficiency** – We found that fewer tests and faster treatment created efficiencies. We have focused on the value of those efficiencies to the healthcare system. They are estimated at \$82 per person, for a total of \$11 million over the MedicAlert membership.
- **Avoided harm** – Our survey and the literature suggest that issues with medical treatment are causing harm and that MedicAlert identifications can avoid some of it. The private benefits are estimated at \$38 million, over half of which is due to avoided deaths. The public benefits are estimated at \$15.5 million from avoided costs of dealing with harm to patients.

These are benefits MedicAlert currently produces with its existing membership.

1	<i>'I had fewer medical tests'</i>	2	<i>'My treatment was faster'</i>
3	<i>'I avoided a potential allergic reaction'</i>	4	<i>'I had more confidence that I was getting the right treatment'</i>

Wellbeing benefits

MedicAlert improves the wellbeing of its members, beyond the more efficient treatment and avoided harm. Wellbeing benefits arise because members have confidence that they are receiving the right treatment, and because they have peace of mind while they are out in the community.

Wellbeing benefits, in our framework, are a private benefit for individuals who are members. We do not include them as part of the public benefits.

We have not put a dollar value on wellbeing benefits. It is possible to value them, but that exercise was beyond the scope of the current work. However, it is important not to lose sight of this important benefit of MedicAlert identification.



Avoided health care costs in ambulance

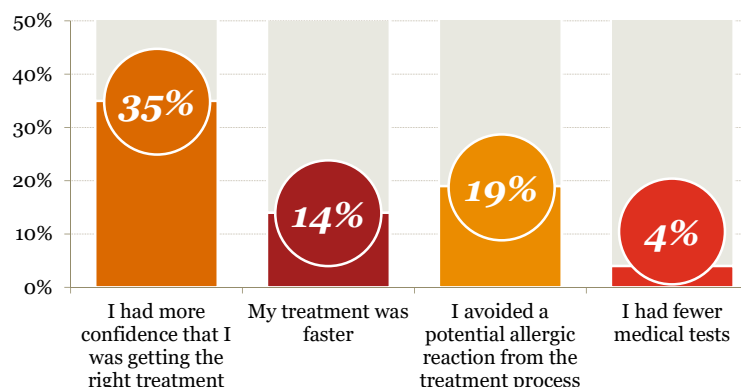
Individual benefits

Among people who had their ID checked⁽¹⁾,

77% reported benefits from their MedicAlert ID.

(46% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ambulance cost of care by 0.9%, or \$14, per user on average^(2,3)

Scaling survey responses to the registered MA population, checking MA ID is estimated to reduce health costs attributable to ambulance fees by \$372k.

(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C.

+ *Avoided health care costs in emergency departments*

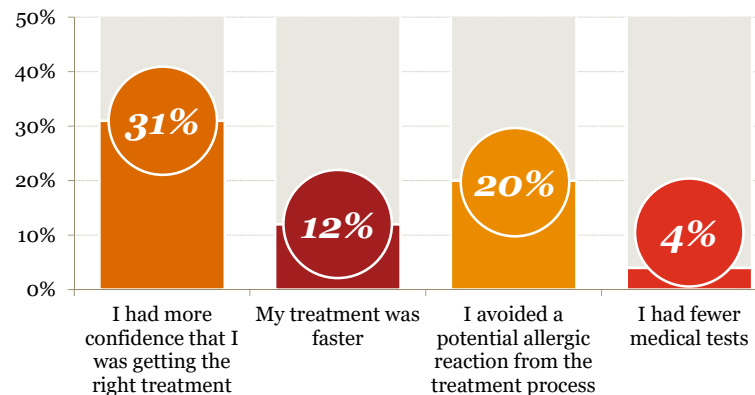
Individual benefits

Among people who had their ID checked⁽¹⁾,

57% reported benefit from their MedicAlert ID.

(51% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ED cost of care by 1.9%, or \$7, per user on average^(2,3)

Scaling survey responses to the entire MA population, checking MA ID is estimated to reduce health costs attributed to ED by \$241k.

(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C.



Avoided health care costs during day stay at a medical facility

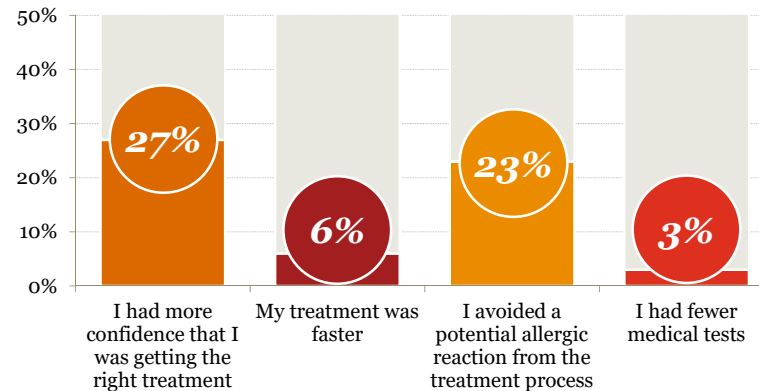
Individual benefits

Among people who had their ID checked⁽¹⁾,

61% reported benefit from their MedicAlert ID.

(45% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ED cost of care by 1.1%, or \$8, per user on average^(2,3)

Scaling survey responses to the entire MA population, checking MA ID is estimated to reduce health costs attributed to day stay by \$145k.

(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C.



Avoided health care costs during overnight stay in hospital

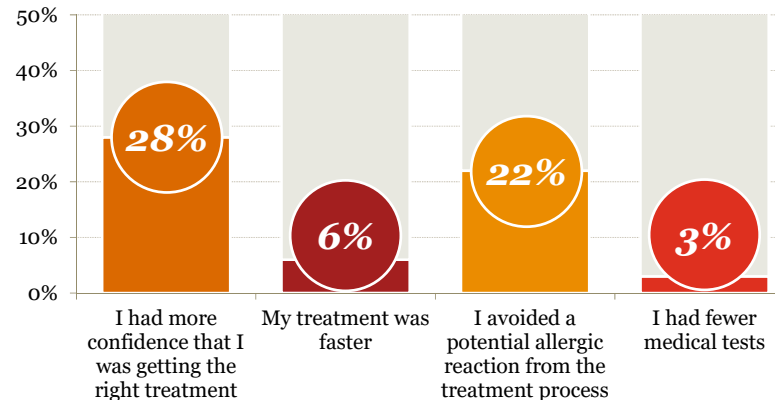
Individual benefits

Among people who had their ID checked⁽¹⁾,

57% reported benefit from their MedicAlert ID.

(35% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ED cost of care by 0.9%, or \$46, per user on average^(2,3)

Scaling survey responses to the entire MA population, checking MA ID is estimated to reduce health costs attributed to hospital by \$1.5m.

(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C/



Avoided health care costs during a consultation with a GP

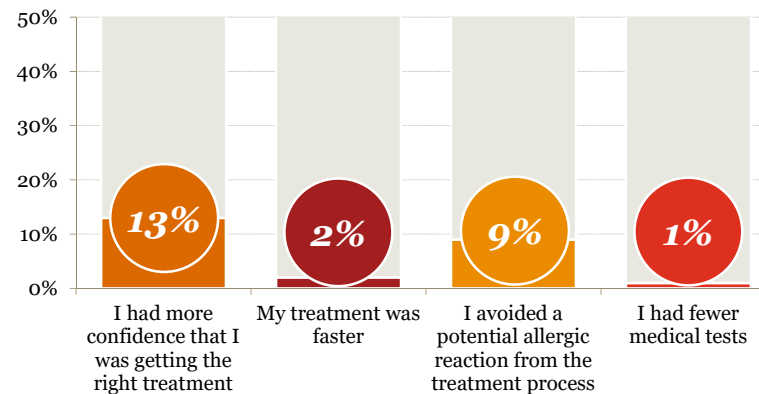
Individual benefits

Among people who had their ID checked⁽¹⁾,

34% reported benefit from their MedicAlert ID.

(39% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ED cost of care by 4%, or \$3, per user on average^(2,3)

Scaling survey responses to the entire MA population, checking MA ID is estimated to reduce health costs attributed to GP visits by \$254k.

(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C.



Avoided health care costs during a consultation with another doctor or specialist

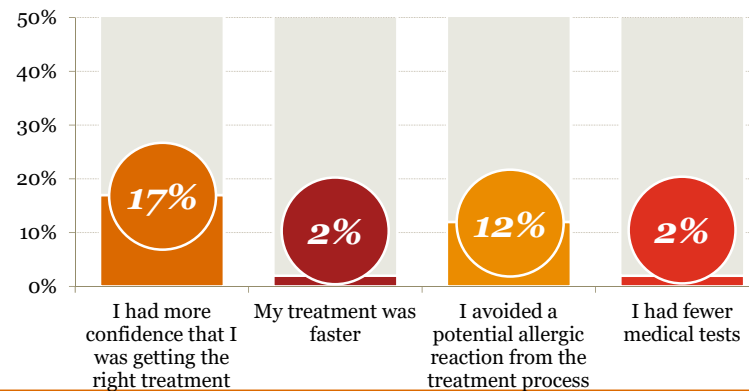
Individual benefits

Among people who had their ID checked⁽¹⁾,

37% reported benefit from their MedicAlert ID.

(21% of these were in this situation because of illness or physical symptom)

Where MedicAlert IDs were checked, the following benefits were reported:



Checking MA ID may reduce ED cost of care by 0.9%, or \$3, per user on average^(2,3)

Scaling survey responses to the entire MA population, checking MA ID is estimated to reduce health costs attributed to specialists by \$163k.

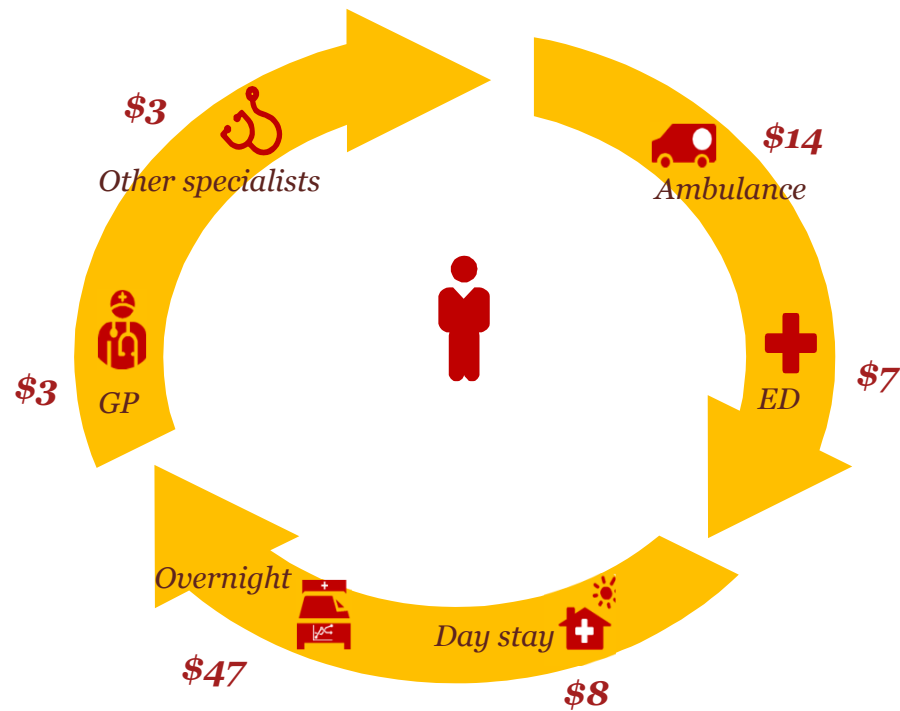
(1) These are people who meet all three of the following criteria: they know whether or not their MA ID was checked, they confirm that it was checked and they have experienced this event during the last two years.

(2) Calculated by the prevalence of the user reported benefits of faster treatment and fewer medical tests multiplied by the average incidence of this event.

(3) Costs associated with faster treatment and fewer medical tests, following the assumptions listed in Appendix C.



Current public cost savings due to efficiencies in the medical system per visitation



On average, a MA user has saved the NZ health system **\$12.27 per event⁽¹⁾** and **\$82 annually per person**

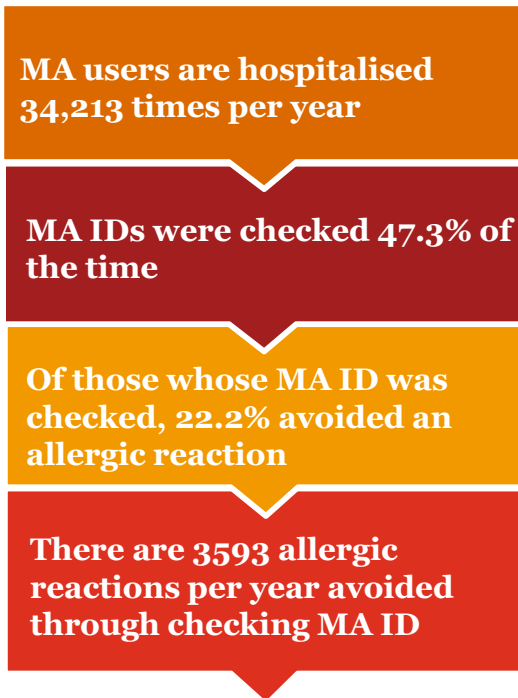
Scaling survey responses to the registered MA population, **checking MA ID may reduce total costs to the health system by \$2.6m per year⁽³⁾**

* Costs attributed to avoided allergic reaction or improved customer experience have not included in this figure.

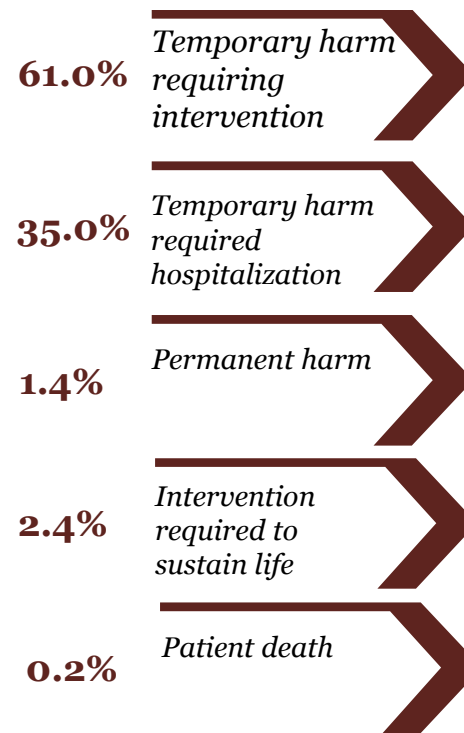
- (1) The savings for the health system from each sector (ambulance, ED etc.) from using MedicAlert were summed, then divided by the number of sectors to calculate the average saving per event.
- (2) Avoiding a potential allergic reaction from each sector (ambulance, ED etc.) from using MedicAlert were summed, then divided by the number of sectors to calculate the average saving per event.
- (3) Sum of all average benefit per sector by those surveyed, scaled to the MA population of 91,806.

Current costs saved through avoided adverse reactions

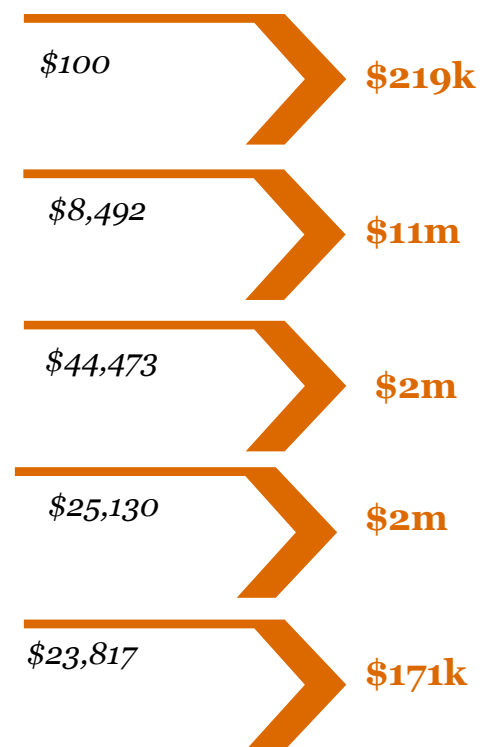
Allergic reactions avoided:



Severity of event:



Cost savings per event:



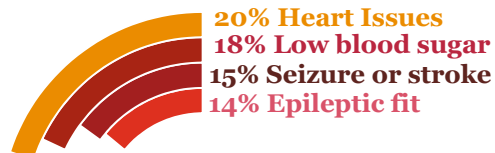
\$15.5 million is saved per year from avoided adverse events through the use of MA ID

Focus : people who can't speak for themselves



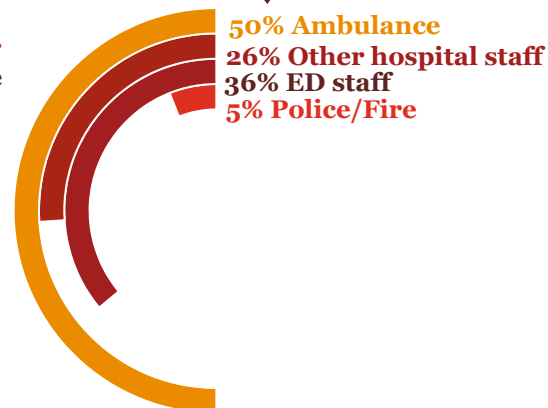
11% MA users surveyed experienced at least one situation during the last 2 years where they were not able to speak for themselves

Main reasons



29% MA users have had their ID checked when unconscious (among those informed whether their ID was checked or not)⁽¹⁾

Health services attended most frequently ⁽²⁾



Value impact

For surveyed MA users who may fall unconscious due to an underlying health condition, the MedicAlert ID is able to give critical medical information that could avoid an adverse health event.

There are approximately 3,600 avoided allergic reactions per year in the MA population.

ADEs lead to several categories of harm, with associated costs.

- (1) Of those who responded they had fallen unconscious in the last 2 years, 29% reported to have had their MA checked.
(2) Health service where the user reported their MA was checked when they were unconscious.

The value of avoided deaths

Avoided deaths are a significant benefit

Some ADEs cause deaths, and some of those deaths are preventable. Although these deaths do result in healthcare costs, the main impact is on the patient who dies.

Putting a value on a person's life may seem heartless, but there are several areas of public policy where the value of a life is important. For healthcare and transport investment, policy-makers need to balance costs and benefits, including the benefit of fewer untimely deaths.

For transport projects in New Zealand, the Ministry of Transport uses a standard value of a life saved. Currently, the value is over \$4 million. This value is applied uniformly for all lives regardless of age or other personal details.

Healthcare analysis uses the more detailed metrics DALY (disability-adjusted life year) and QALY (quality-adjusted life year). These values apply to a single year, and are multiplied by the number of years lost or saved. A common value for DALYs is \$50,000 (per year).

Using DALYs tends to lead to lower estimated benefits from avoided deaths. However, work by New Zealand economists has called into question the assumption that the lives of older people should have a lower value.

Ministry of Transport (2016), Social cost of road crashes and injuries 2015 update

“The loss of life and life quality component represents over 90 percent of the total social cost of road injuries.... The updated VOSL is \$4.06 million per fatality, at June 2015 prices.”

Blakely et al (2012), Burden of Disease Epidemiology, Equity and Cost Effectiveness (BODE) Study Protocol

“[There is] a common threshold of about \$50,000 per DALY.”

Edwards (2011), Cost-effectiveness analysis in practice

“DALYs continue to be widely used both as a measure for estimating the global burden of disease and as an outcome measure for use in cost-effectiveness analysis.”

Guria and Yeabsley (2014), Valuing Prevention of Death and Loss of Life Quality: Policy Implications of Using Value of Statistical Life and Quality Adjusted Life Year Estimates

“However, studies show that accumulation of endowments and longer life expectancy means the WTP [willingness to pay] for health and safety improvement of elderly people is not lower than the average, and may be higher.”

Wellbeing benefits

MedicAlert members reported many personal wellbeing benefits that we did not quantify.



When we surveyed MedicAlert members, they told us that their identifications gave them a sense of security and safety and helped their peace of mind. This improved wellbeing is an important personal, private benefit from using MedicAlert.

We have not quantified this improved wellbeing in monetary terms. There are valuation methods that could be used in future research. Notably, there are now international libraries of estimates for positive outcomes such as:

- Agreement that “I feel in control of life”
- Increased involvement in decision making
- Improved overall health.

It would also be possible to extrapolate the felt wellbeing of current MedicAlert members to the wider population of New Zealand, although there would be issues to resolve.

Regardless of the technical valuation issues, the important point is that members’ lives are improved in intangible ways, and those improvements are valuable.

Total public and private benefits currently delivered

	Public impacts <i>Savings across government</i>	Private impacts <i>Benefits to individuals</i>
Surveyed Impacts	Efficiency \$82 per person from faster service and fewer tests \$2.6m for existing MA users	Efficiency <i>Not valued</i>
	Avoided harm \$15.5m based on survey responses, scaled to the MA population	Avoided harm Private:public is 0.52:0.48 \$17m avoided losses 7 avoided deaths \$21m (\$3m each)

Delivered

Value: \$56m

Lives: 7 saved

BCR: 11.17*

* Assumes 91,806 MedicAlert members and \$50 annual fee, for a total cost of delivery of \$5m.

Section 4

Potential national benefits

Introduction and summary of potential national benefits

Scaling up the benefits to the national population

MedicAlert has the potential to generate additional public and private benefits through increased use of MedicAlert IDs. Currently, only 2.06% of the NZ population have registered MedicAlert IDs, yet 22% of the population have at least one of the four conditions included in this study (allergy, heart disease, respiratory disease, diabetes). MedicAlert reports that thousands of medical conditions such as allergies, adverse reactions, medical risks, implanted devices and treatment risks are supported by its service, with the average member having 2.63 medical risks.

Furthermore, our survey indicates that MedicAlert IDs are only checked between 22% and 65% of the time, depending on the type of service used. If a policy were implemented that could lift the checking of MedicAlert IDs to 80%, this step alone has the potential to raise the avoided harm from MedicAlert IDs from the current \$15.5 million to a potential \$26.2 million.

We scaled up the benefits of MedicAlert to all those in the New Zealand who could benefit from it, using figures from the literature. Methodological details are provided in the appendix.

The results show:

- Public benefits of \$38 million to \$77 million per year
- Private benefits of \$65 million to \$165 million per year
- Total potential national benefits of \$102 to \$242 million per year.

Not all of the possible benefits have been assigned dollar values, so the above figures do not represent the full scale of potential benefits.

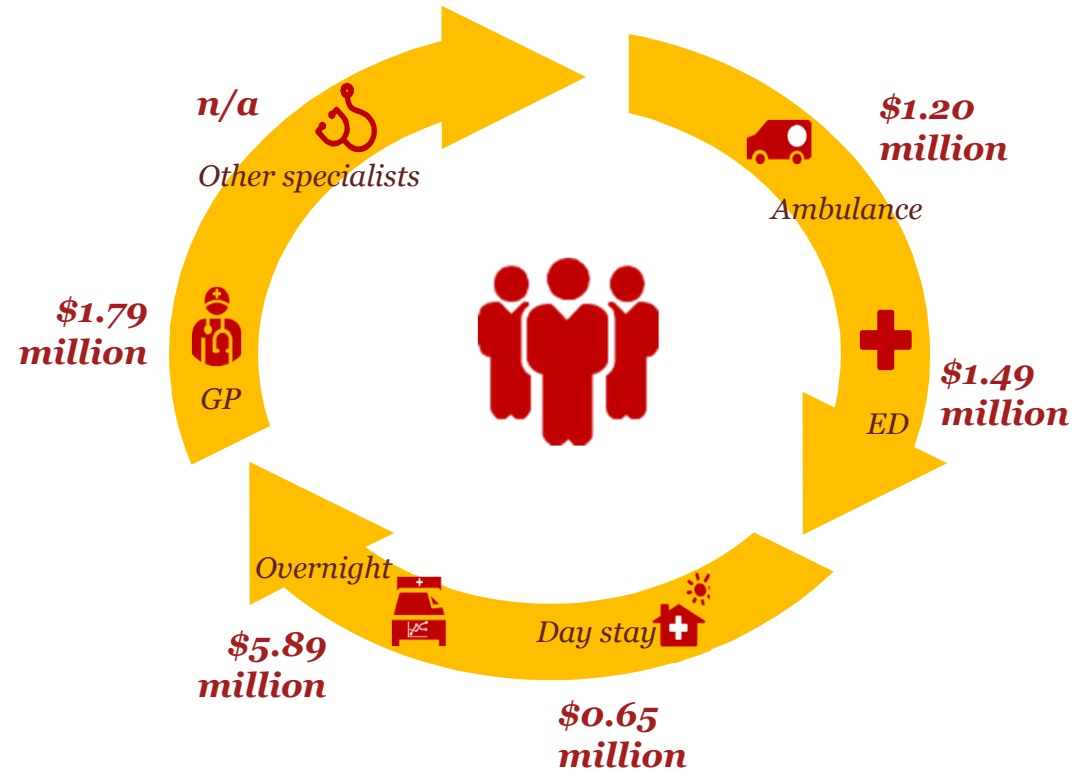
Potential national public benefit through increased efficiency

Scaling up the benefits of increased efficiency:

The annual individual costs were scaled up using the national number of service uses and percentage of improvement (22% of the population who could be MedicAlert users with a 90% rate of checking MedicAlert IDs) .

\$11m is the potential national benefit from increased efficiencies through the use of MedicAlert IDs

Potential national benefits through increase efficiency across the following services:



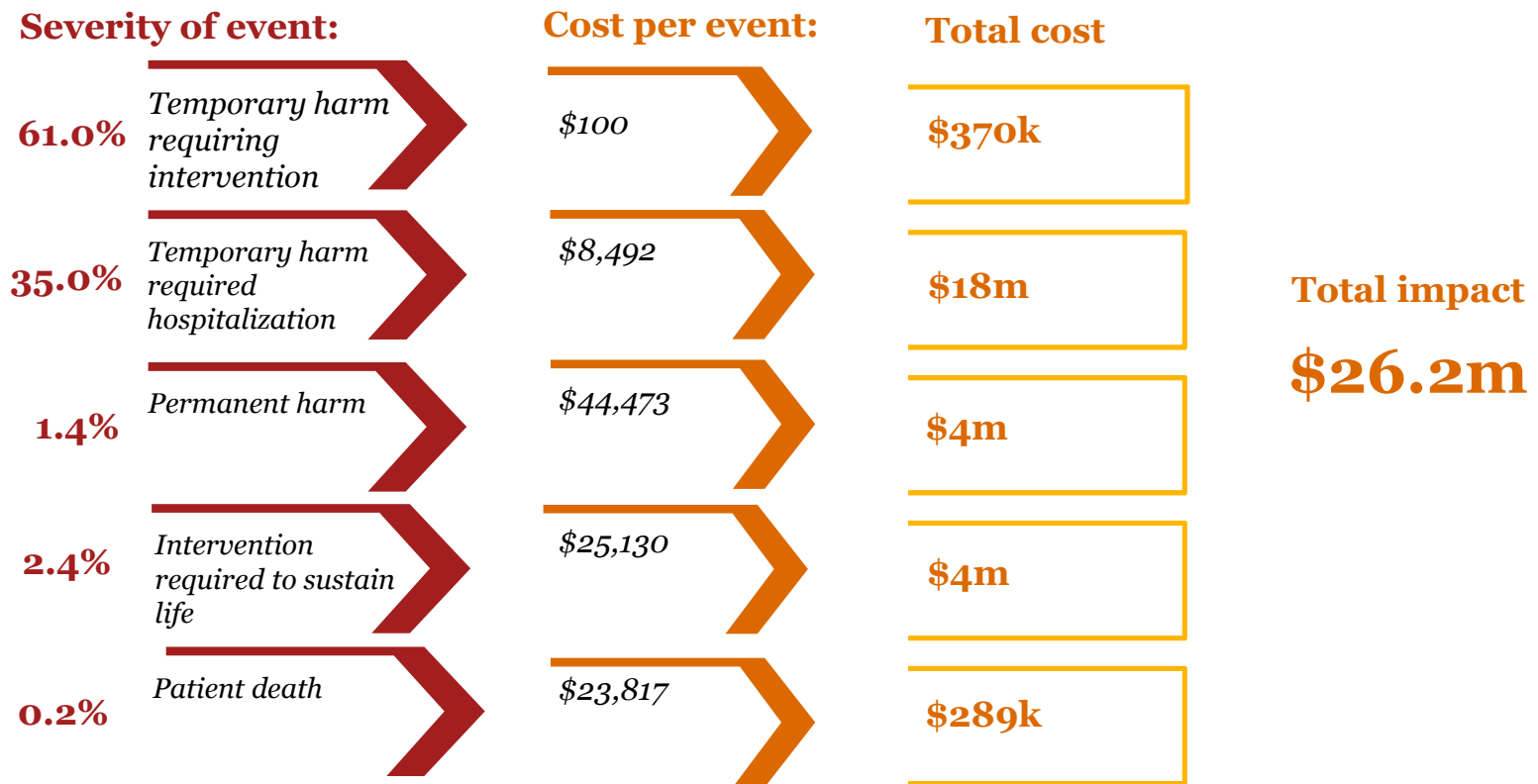
Potential national public benefit through avoided harm

Severity of event:	Cost per event:	Total cost	
61.0% Temporary harm requiring intervention	\$100	\$940k (high) \$376k (low)	Scenario 1 (high): 15,412 avoidable ADE's annually that are preventable by MA
35.0% Temporary harm required hospitalization	\$8,492	\$46m (high) \$18m (low)	
1.4% Permanent harm	\$44,473	\$10m (high) \$4m (low)	
2.4% Intervention required to sustain life	\$25,130	\$9m (high) \$4m (low)	
0.2% Patient death	\$23,817	\$724k (high) \$294k (low)	
			Scenario 2 (low): 6,165 avoidable ADE's annually that are preventable by MA

Between \$27m (low) and \$66m (high) could be saved per year through the use of MA IDs to avoid adverse reactions

Potential benefit in checking MedicAlert IDs more frequently

At present, MedicAlert IDs are checked 47.3% of the time. If that rate were increased to 80.0%, the total impact would be \$26.2 million, an increase of \$10.7 million over the currently delivered benefits of \$15.5 million (see page 28).



Potential private national benefits

In our framework, there are three sources of private benefits for individuals:

- **Efficiency** – The reduced time spend in medical treatment creates time savings for individuals. This savings will have a value to individuals. However, we have not include this value in our estimates of national private benefits.
- **Wellbeing** – The survey findings clearly show that MedicAlert members value the peace of mind that their IDs provide. However, we have not put a dollar value on these benefits and have not scaled them up to the national level.
- **Avoided harm, including death** – These benefits are valued below.

Avoided death

In assessing the benefit of MedicAlert in avoiding death the high and low approach was applied with a ratio of 12 to 31. This was further valued at \$3 million.

In assuming the potential benefits of MedicAlert a high of 50% and a low of 20% were used and A ratio of 0.52:0.48 has been applied

Avoided harm

Avoided death

Low
\$29 million

High
\$72 million

Avoided harm

Low
\$36 million

High
\$93 million

Summary of national benefits

Total potential national benefit

The value of the total potential national benefits is shown below. This value includes both **public** and **private** impacts, comprising both **efficiency** and **avoided harm** estimates. Wellbeing values and private efficiency values are additional to the dollar values shown.

The MedicAlert technology has the potential to avoid harm by reducing ADEs in hospitals. Potential mechanisms include increasing the number of MedicAlert members, promoting regular checking of IDs and improving data accuracy and completeness. These measures would benefit medical providers and MedicAlert members and should lead to fewer ADEs. The avoided ADEs were shown above on page 12; the diagram below shows the potential economic impacts.

	Public impacts <i>Savings across government</i>	Private impacts <i>Benefits to individuals</i>	
National Potential	Efficiency \$11m from faster service and fewer tests	Efficiency <i>Not valued</i>	Potential High: \$242m Low: \$102m
	Avoided harm High: \$66m (50% preventable with MA) Low: \$27m (20% preventable with MA)	Avoided harm Private: public is 0.52:0.48 High: \$72m Low: \$29m Avoided deaths: 12 to 31 \$36m to \$93m (\$3m each)	

Section 5

Summary of benefits

Annual economic impacts of MedicAlert: summary

	Public impacts <i>Savings across government</i>	Private impacts <i>Benefits to individuals</i>	
National Potential	<p>Efficiency \$11m from faster service and fewer tests</p> <p>Avoided harm High: \$66m (50% preventable with MA) Low: \$27m (20% preventable with MA)</p>	<p>Efficiency Not valued</p> <p>Avoided harm Private: public is 0.52:0.48 High: \$72m Low: \$29m Avoided deaths: 12 to 31 \$36m to \$93m (\$3m each)</p>	<p>Potential</p> <p>High: \$242m</p> <p>Low: \$102m</p>
Surveyed Impacts	<p>Efficiency \$82 per person from faster service and fewer tests \$2.6m for existing MA users</p> <p>Avoided harm \$15.5m based on survey responses, scaled to the MA population</p>	<p>Efficiency Not valued</p> <p>Avoided harm Private: public is 0.52:0.48 \$17m avoided losses 7 avoided deaths \$21m (\$3m each)</p>	<p>Delivered</p> <p>Value: \$56m</p> <p>Lives: 7 saved</p> <p>BCR: 11.17*</p>

* Assumes 91,806 MedicAlert members and \$50 annual fee, for a total cost of delivery of \$5m.

Section 6

Discussion of results

Is a high benefit-cost ratio credible?

Social sector BCRs are often lower

In the social sector – education, healthcare, justice, etc. – policy interventions and other measures usually have lower benefit-cost ratios (BCRs). Proposed and actual interventions often have BCRs between 1.0 and 2.0. Some reasons are:

- Programmes have multiple rationales, so may be undertaken despite low BCRs
- The obviously important work is well accepted and not assessed with BCRs. Changes happen around the edges, where it isn't clear whether there is value
- Targeting is difficult. Interventions may be too broad, covering people who do not need them
- Costs are often high. Social sector work can be labour-intensive; technology can have a limited impact on delivery costs.

MedicAlert is efficient and inexpensive

MedicAlert can be efficient because it targets only the people who need it and provides services only to them.

Other social sector programmes can be less cost-effective because they end up working with people who don't need them. Sometimes, an intervention has to screen a lot of people to identify the ones who would benefit. For other programmes, it can be hard to screen out people who don't need the intervention.

MedicAlert is tightly focused on its target group.

- Members self-select for MedicAlert because they know they have an issue. MedicAlert does not have to screen a large population to fit its target group.
- Their medical needs have been confirmed by medical professionals. MedicAlert is not providing services to people who won't benefit.

The MedicAlert intervention is inexpensive, but it fills a particular information gap.

MedicAlert consists of an identification on the person, a database maintained by the MedicAlert Foundation, and protocols for medical staff to use that information. All three parts of the information system are inexpensive to produce and maintain.

Information tends to be produced by people who know they will benefit from it. General practitioners, District Health Board and the Ministry of Health all benefit a little from prior knowledge about members' conditions. However, the people who benefit most are the members themselves.

This is especially true about low-probability, high-impact problems. Members benefit the most from avoiding them.

MedicAlert information is produced and maintained by people who benefit from it.

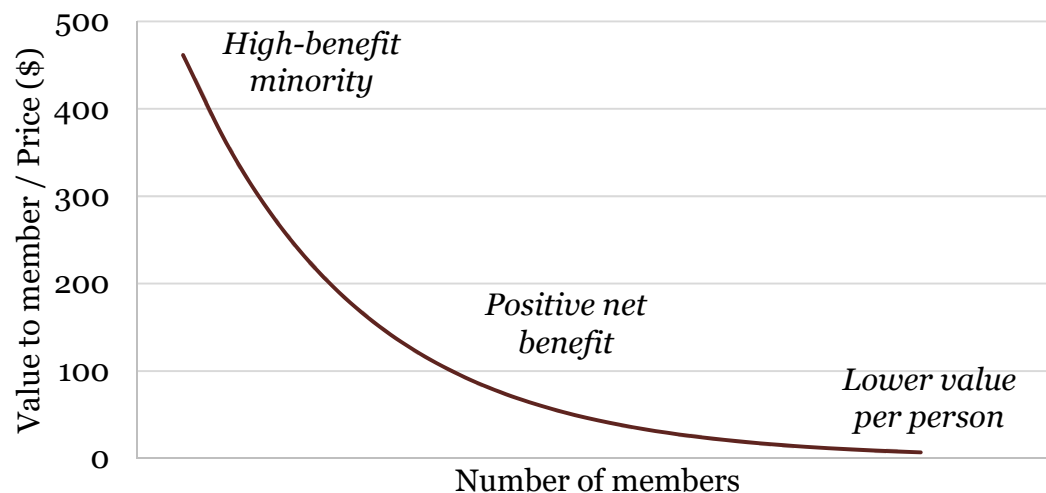
Does MedicAlert already cover everyone who would benefit?

Many people are already members

MedicAlert Foundation has reported over 170,000 enrolments in its annual reports to the New Zealand Companies Office, and maintains a database of over 90,000 current members.

The graph below illustrates that people get different value from MedicAlert depending on their needs. A minority of people with severe problems will benefit greatly from MedicAlert; they will be willing to pay hundreds of dollars per year for it. A larger number of people could benefit, but at quite a low level; they are unlikely to pay the membership fee. In the middle are people who may join, depending on how they weigh up their personal costs and benefits.

Benefit to members vs number of members



Who is left to cover?

If we think that most high-benefit people have already joined MedicAlert of their own initiative, who else is there to cover? This is an important question: MedicAlert might provide a lot of benefit to *existing* members, but may have declining value for *additional* members.

Additional members could include:

- The normal increase in membership from historical rates of covered conditions
- More people with non-communicable diseases and allergies, whose incidences are increasing
- People with high needs but who lack the ability to pay
- People who would have a net benefit but have not had a compelling reason to join.

Finally, greater efficiency through economies of scale could lower the unit cost and bring in more people from the lower right of the graph.

Caveats and limitations for the work

This study has pulled together data from different sources in order to estimate the economic impact of medical issues and avoided harm. We encountered several difficulties in conducting this research.

- There is **limited data on the incidence of medical issues**, including ADEs. Key data used here is over 15 years old. It is, however, based on peer-reviewed studies using chart reviews.
- There are **several classifications and definitions** across different pieces of research. We have worked to harmonise the classifications, but they may not be exactly comparable.
- There are **no economic values for wellbeing benefits**. Respondents expressed a number of lifestyle benefits from using MedicAlert identification, such as ‘peace of mind’. They have not been included in the economic values, however.

Using survey-based research has limitations, especially when trying to draw wider conclusions from a single data set.

- Survey response data is likely to have **response bias**, even when the number of responses is high. It is likely that some members were keen on responding to the survey because they had experienced a problem with their medical treatment.
- The survey asked people to remember things that happened while they were in emergency situations or undergoing medical care. Their **memories of the details may not be exact**.
- The **survey used everyday language** in order to communicate easily with respondents. The responses might have different meanings to respondents, to us as social science researchers, and to medical professionals.

Appendices

Appendix A – Data sources

Literature review results

1

	Results	Sources
Population suffering from allergy in NZ	Allergy : 5% of the population overall are likely to have a food allergy : 223,550 (among them 50% have asthma)	www.allergy.org.nz/site/allergynz/What%20is%20the%20prevalence%20of%20food%20allergy%20in%20New%20Zealand.pdf
Population suffering from heart diseases in NZ	Heart diseases (only among adults :+15y.) : 172000	www.heartfoundation.org.nz/statistics
Population suffering from diabetes in NZ	Diabetes: 222000 among them 47% have a heart disease*	Annual Update of Key Results 2014/15: New Zealand Health Survey (Ministry of Health) * cdc.gov/diabetes/statistics/cvd/fig2.htm
Population suffering from respiratory diseases in NZ	Respiratory diseases : 700,000	www.asthmafoundation.org.nz/research/key-statistics
Number and percentage of the population have at least one of the main reasons to wear an MA ID.	976,452 potential users (22%)	Above
Number of people falling unconscious per year in NZ	Approximation : 7,576 life-threatening ED event per year (in 2014/15) where treatment has to be immediate (ATS 1).	www.health.govt.nz/publication/emergency-department-use-2014-15
Public benefit to private benefit ratio	0.48:0.52	Brown, P. M., McArthur, C., Newby, L., Lay-Yee, R., Davis, P., & Briant, R. H. (2002). Cost of Medical Injury in New Zealand: A retrospective cohort study. Thomas, E, D Studdert, JP Newhouse, BW Zbar, KM Howard, EJ Williams and TA Brennan, "Cost of medical injuries in Utah and Colorado," <i>Inquiry</i> , 1999, 36 (Fall), 255-264.

Literature review results

2

	Unit cost (NZD)	Sources
Ambulance	\$746 per incident	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
ED	\$376 per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Hospital (overnight)	\$5,098 per inpatient hospital visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Day stay	\$761*	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
GP	\$80 per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Other specialists	\$322 (\$188 if subsequent) per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax

NB : All costs exclude GST

Literature review results

3

	Unit cost (NZD)	Sources
Ambulance	\$746 per incident	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
ED	\$376 per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Hospital (overnight)	\$5,098 per inpatient hospital visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Day stay	\$761*	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
GP	\$80 per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax
Other specialists	\$322 (\$188 if subsequent) per visit	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax

Literature review results

4

Event	Event per year in NZ	Sources
Ambulance	440,000 incidents in 2015/16	http://www.health.govt.nz/new-zealand-health-system/key-health-sector-organisations-and-people/naso-national-ambulance-sector-office/emergency-ambulance-services-eas/review-funding-arrangements-emergency-road-ambulance-services
ED	1,062,047 ED events reported in 2014/15	ED report MoH http://www.health.govt.nz/publication/emergency-department-use-2014-15
Hospital (overnight)	698,972 hospitalisations	http://www.health.govt.nz/publication/publicly-funded-hospital-discharges-1-july-2013-30-june-2014 (LoS : 6.7 days)
Day stay	424,890 day stay in hospital	http://www.health.govt.nz/publication/publicly-funded-hospital-discharges-1-july-2013-30-june-2014
GP	12.4 million GP consultations	http://www.health.govt.nz/nz-health-statistics/health-statistics-and-data-sets/primary-care-data-and-stats
Other specialists	n/a	n/a
ADE's	28% of patients admitted to hospital	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.
ADE's with a degree of preventability	67% of ADE's	Brown PM, McArthur C, Newby L, Lay-Yee R, Davis P & Briant RH (2002). Cost of medical injury in New Zealand: a retrospective cohort study (Phase 1 report)
ADE's associated with medication error	25% of ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.

Literature review results

5

Severity of adverse drug reaction	Percentage of ADE's	Sources
Temporary harm requiring intervention	61% of total ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.
Temporary harm to the patient requiring hospitalisation	35% of total ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.
Permanent patient harm	1.4% of total ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.
Intervention required to sustain life	2.4% of total ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.
Patient death	0.2% of total ADE's	Robb G, Loe E, Maharaj A, Hamblin R, Seddon ME (2017). Medication-related patient harm in New Zealand hospitals.

Literature review results

6

Cost reduction hypothesis	Results	Sources
Faster treatment Go home sooner	No evidence that better information (thanks to IT solutions) implies faster treatment in the literature → No standard time, and instead a 10% reduction in cost of treatment is assumed	
Fewer medical tests	Average cost of a routine medical test \$47.42	LabPLUS Price List
Temporary harm requiring intervention	No evidence found of this cost - \$100 per ADE was assumed	
Temporary harm to the patient requiring hospitalisation	\$5,235 was the 2001 cost per ADE of patients who suffered no or minimal disability, this was inflation by the Health CPI to get the 2017 cost of \$8,492	Brown PM, Mcarthur C, Newby L, Lay-Yee R, Davis P & Briant RH (2002). Cost of medical injury in New Zealand: a retrospective cohort study (Phase 1 report)
Permanent patient harm	\$27,415 was the 2001 cost per ADE of patients who suffered a permanent disability, this was inflation by the Health CPI to get the 2017 cost of \$44,473	Brown PM, Mcarthur C, Newby L, Lay-Yee R, Davis P & Briant RH (2002). Cost of medical injury in New Zealand: a retrospective cohort study (Phase 1 report)
Intervention required to sustain life	\$15,491 was the 2001 cost per ADE of patients who suffered no or minimal disability, this was inflation by the Health CPI to get the 2017 cost of \$25,130	Brown PM, Mcarthur C, Newby L, Lay-Yee R, Davis P & Briant RH (2002). Cost of medical injury in New Zealand: a retrospective cohort study (Phase 1 report)
Patient death	\$14,682 was the 2001 medical cost per ADE of patients who died, this was inflation by the Health CPI to get the 2017 cost of \$23,817	Brown PM, Mcarthur C, Newby L, Lay-Yee R, Davis P & Brian tRH (2002). Cost of medical injury in New Zealand: a retrospective cohort study (Phase 1 report)

Literature review results

7

Value of avoided death	Results	Sources
The relationship between age and the value of avoided death is complex. Using DALYs may understate the value.		Guria, J. and Yeabsley, J. (2014). Valuing prevention of death and loss of life quality: policy implications of using Value of Statistical Life and Quality Adjusted Life Year estimates. <i>Public Health Frontier</i> , 3(2), 19-27.
Brief discussion of the used of DALYs	Calculation process for DALYs	World Health Organisation (WHO). (2016). Metrics: Disability-Adjusted Life Year: http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/#
Discussion of the Value of a Statistical Life	Value at June 2015 was \$4.06 million	Ministry of Transport. (2016). Social cost of road crashes and injuries 2015 update. Wellington.
Detailed discussion of the use of DALYs	“In the standard burden-of-disease calculation, the number of years lost through premature mortality was calculated on the basis of Japanese life expectancies, namely 82.5 years for women and 80 years for men, because life expectancy in Japan is the highest in the world (Homedes, 2000).”	Edwards, C. (2011). Cost-effectiveness analysis in practice. Eds. John Cameron, Paul Hunter, Paul Jagals and Katherine Pond. <i>Valuing Water, Valuing Livelihoods</i> . London: IWA Publishing.
Protocol for an extension study on the burden of disease, including economic impacts	The value of a DALY is \$50,000	Blakely, T., Foster, R., and Wilson, N. (2012). Burden of Disease Epidemiology, Equity and Cost-Effectiveness (BODE) Study Protocol. <i>Public Health Monograph Series, No.30</i> , Department of Public Health, University of Otago, Wellington.

Appendix B– Methodology

Steps to provide descriptive statistics:

- Data for analysis was cleaned by removing all those who ‘did not have time’ to fill in the survey. This reduced the number of total survey responses from 7114 to 5500.
- Average age of respondents: Average ages were calculated by summing the age of every respondent, and dividing by the total number of respondents. 4130 respondents provided their age.
- Number of years using MedicAlert: A free text box was used for this response. Answers were converted to a numerical value. For responses that gave a range, for example 20-30 years – the midpoint was taken, 25 years. Where a numerical value could not be applied, or the respondent did not know, the datapoint was removed from the calculation. Data from 3808 responses was taken.
- Main reason for using MedicAlert: Respondents were able to answer more than one option for this question. Percentages were calculated using the number of respondents, such that the share of conditions diagnosed added to more than 100%. 4089 respondents answered the question, with 6432 responses, implying more than 50% of respondents had more than one reason they used MedicAlert.
- Conditions diagnosed: There is the potential for more than one condition to be diagnosed to a respondent. Percentages were calculated on the number of respondents, such that the share of conditions diagnosed added to more than 100%. 4089 people answered the question, with 7200 responses.
- Benefit of MedicAlert: A free text box was used for this response. Answers were coded according to the main responses given, and placed into one category. 3848 responses were coded this way.

Descriptive statistics for each sector (ambulance, ED, day stay at hospital, overnight hospital, GP and other specialist) was calculated in the same way. Main steps included:

- Benefits of MedicAlert: Those that found benefit were summed and divided by total responses.
- Percent in situation due to physical illness: For all those who found benefit from MedicAlert (in each sector), the number of those that were there because of illness or physical symptom were divided by the total number who found benefit from MedicAlert.
- Benefits of MedicAlert: Among people sure there ID was checked and saying there are benefits. Respondents could answer more than one option, hence percentages were calculated using the total number of respondents such that shares could add to more than 100%.

To calculate the individual efficiency costs from checking MedicAlert ID, a number of steps were taken:

- Cost of the service: The cost of each service was gathered from the literature, to give a base starting cost of using the service.
- Cost reduction factors: Benefits found from having MedicAlert (survey responses) were taken for each sector. The first three questions relate to direct costs faced by the medical system, where the fourth relates to the saved cost of avoiding an adverse situation/reaction:
 - My treatment was faster
 - I had fewer medical tests
 - I got to go home sooner
 - I avoided a potential allergic reaction from the treatment process
 - Survey responses were multiplied by cost reduction assumptions to provide a percentage cost reduction off the baseline. For example, faster treatment was assumed to reduce costs by 10%, if 5% of MedicAlert respondents received faster treatment then the cost reduction is calculated at 0.5% off the cost of the service.
- Total benefit from efficiencies: Each cost saving was summed to provide an overall cost reduction from checking MedicAlert ID.

Individual results on cost savings from efficiencies were scaled to the total MedicAlert population.

- MedicAlert members: The total number of MedicAlert users was provided by MedicAlert. Details included age and gender (where provided). 5-year age buckets were used to provide a distribution of MedicAlert members: in total and by gender. There were a total of **91,806** members in the database.
- Other distributions: Similar distributions were created for the total survey responses, from demographic information provided by respondents. Another distribution was created for those that have used the service in the last 2-years. This creates 3 distributions in total, that can scale results from the individual level to the MedicAlert database.
- Scaling usage of each sector to the MedicAlert database level: To get an estimate of the usage of each service by the MedicAlert population, the three distributions already calculated are used. The number of people (both female and male) in each age group that used the service in question, is divided by the number that responded to the survey in each age group in aggregate - to give a percentage of survey respondents that used each service. This share is multiplied by the corresponding number of people in each age group in the MedicAlert database. All age groups are summed to give an estimate of the number of MedicAlert users that used each service over the 2-year period.
- Scaling based on usage of service: The estimated number of MedicAlert users that have used the service is first divided by 2 to make the calculations annual. This is then multiplied by the average usage of each service by MedicAlert members, accounting for the fact that visits to the doctor are likely to be more frequent than the use of other medical services. This gives an estimate on the number of times MedicAlert members accessed each service, and is multiplied by the individual benefit (both direct costs and avoided adverse reaction) of one service to give an estimate of the total MedicAlert member benefit.

To scale individual results to a national level, a number of steps are taken:

- Service provision nationally: Data on the provision (total number) of each service was gathered from the literature review process.
- Share of potential MedicAlert members nationally: Information on the assumed share of population that could use MedicAlert was based on the number and percentage of the population have at least one of the four main reasons to wear an MA ID. 22% of the New Zealand population is assumed to be able to benefit from the use MedicAlert.
- Assumed rate of checking MedicAlert ID: On top of this, 90% of all cases are assumed to have their MedicAlert ID checked when using each service.
- National benefits of checking MedicAlert ID for each service: To calculate the number of cases where checking MedicAlert could lower health care costs, national service provision was multiplied by the share of population that could use MedicAlert (22%), and the assumed share of the times it was checked (90%) to give a number of cases where health costs could be reduced. This was in turn multiplied by the individual cost efficiency benefits per individual to give a monetary benefit to the New Zealand health system.
- Total national efficiency benefits: Results and benefits from each sector can then be aggregated together to give an overall estimate of the efficiency benefits from MedicAlert.

The current benefit from avoiding allergic reactions was calculated using the following steps:

- The number of hospitalisations was scaled up to the MedicAlert population, using the same methodology as previously discussed. This gave the number of annual hospitalisations of MedicAlert users.
- The percentage of those whose MedicAlert IDs were checked in hospital (47.3%) and the percentage of those who had their bracelet checked that avoided an allergic reaction (22.2%) was multiplied by the number of hospitalisations by MedicAlert users to calculate the number of allergic reactions avoided.
- For both scenarios, the number of allergic reactions avoided by MedicAlert were split into severity groups based on assumptions from the literature. From there, a cost per event was assigned to each severity group and multiplied by the total number of ADE's in that group to form the estimate for current avoided public costs of allergic reactions from the use of MedicAlert.
- The public benefit to private benefit ratio was assumed to be 0.48:0.52. The public benefit (above) was multiplied by 1.083 ($0.52/0.48$) to derive the estimate of current avoided private costs of ADE's from the use of MedicAlert.

The potential national benefit of avoiding adverse events was calculated based on figures from the literature:

- The number of annual hospitalisations was multiplied by the percentage of patients who experienced a drug relation harm to calculate the number of annual adverse drug event.
- The figure above was multiplied by the percentage of ADE's that were avoidable (63%) and by the percentage of those which are due to medication errors.
- Assumptions were made regarding the percentage of these avoidable ADE's due to errors which could be preventable by MedicAlert. Two scenarios were run – that 50% of these were preventable by MedicAlert (the high scenario) and that 20% of these were preventable by MedicAlert (the low scenario).
- For both scenarios, the number of ADE's preventable by MedicAlert were split into severity groups based on assumptions from the literature. From there, a cost per event was assigned to each severity group and multiplied by the total number of ADE's in that group to form the estimate for potential public avoidable costs of ADE's from the use of MedicAlert.
- The public benefit to private benefit ratio was assumed to be 0.48:0.52. The public benefit (above) was multiplied by 1.083 ($0.52/0.48$) to derive the estimate of potential avoidable private costs of ADE's from the use of MedicAlert.

Focus on people who can't speak for themselves.

- Share who fell unconscious in the past 2 years: The share of members who have fallen unconscious or found it impossible to communicate with other people, was divided by the number of total responses to the question.
- Share who had their ID checked: Of this group that fell unconscious, the members that had their MedicAlert ID checked were summed and divided by the number of people who fell unconscious.
- Reasons for unconscious: Survey responses were summed then divided by total number of members who fell unconscious.
- Attended to while unconscious: Survey responses were summed then divided by total number of members who fell unconscious.

Appendix C – Disclaimer

Disclaimers

This report has been prepared for MedicAlert and solely for the purposes stated herein and should not be relied upon for any other purpose. We accept no liability to any party should it be used for any purpose other than that for which it was prepared. This report is strictly confidential and (save to the extent required by applicable law and/or regulation) must not be released to any third party without our express written consent which is at our sole discretion.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this report and/or any related information or explanation (together, the “Information”). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

The content of this report is based on information provided to us by MedicAlert and through research. We have not independently verified the accuracy of information provided to us, and have not conducted any form of audit. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

We reserve the right, but will be under no obligation to review or amend our report as a result of this review, or if any additional information, which was in existence on the date of this report, was not brought to our attention or subsequently comes to light.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of

omission or otherwise. The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation to review or amend our report, if any additional information, which was in existence on the date of this report, was not brought to our attention or subsequently comes to light.

This report is not to be copied or released to any other party, or referred to in any public forum, without our prior written consent for each party/purpose requesting its release.

This report is issued in accordance with our letter of engagement with MedicAlert dated 19 August 2016.