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## Health care cost savings from Australian Poisons Information Centre advice for low risk exposure calls: SNAPSHOT 2

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### ABSTRACT

**Introduction:** To estimate cost savings from the Australian Poisons Information Centres (PIC) through reductions in unnecessary health resources following unintentional low toxicity poisonings.

**Methods:** Two telephone surveys were conducted. The first to PIC callers over a one-week period about unintentional exposures where the callers' alternate course of action in the hypothetical situation in which the PIC did not exist was questioned. The second survey to determine the proportion of callers followed PIC advice. We estimated cost savings associated with instances where individuals acted on advice not to present to hospital, when they indicated they would have otherwise as well as savings from preventing unnecessarily utilisation of medical resources. Database records of unintentional poisonings from all Australian PICs for 2017 were used.

**Results:** A total of 958 consecutive callers were surveyed. PIC advised 91% of callers to stay at home, remaining callers were referred to hospital (5%), to their GP (3%) or given other recommended management advice (1%). PIC advice was followed by 97.6% of callers. In PIC absence, 22% of callers who were advised to stay home would have presented to hospital (3% via ambulance), 8% would visit their General Practitioner (GP) and only 9% would stay at home. In 2017, PICs were called about 94,913 unintentional poisonings; and PICs generated at least \$10.1 million in annual savings.

**Conclusion:** In 2017, PICs provided at least a three-fold return on investment for every dollar invested, demonstrating that PICs are a highly cost effective service.

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### Introduction

Australia's four independent state based Poisons Information Centres (PIC) provide a national round-the-clock, free-of-charge emergency poisoning advice. The PICs' clinical advice service provides risk assessment, treatment information and advice to the public and health care professionals for all types of poisonings, medicine queries, chemical exposures, envenomations and toxic hazard situations [1]. Each PIC is staffed by an operations manager, a part-time medical director, Specialists in Poisons Information (SPIs, pharmacists and medical scientists with additional postgraduate toxicology training) as well as on-call clinical toxicologists. PICs offer a three level clinical advice model based on risk assessment. For exposures judged by SPIs as non-hazardous, PICs provide reassurance and home management advice. This can prevent minor exposures from unnecessarily using ambulance, medical and hospital resources. For exposures requiring medical assessment/care, PICs provide advice on management and observation. For the handling of more complex or life-threatening cases, PICs provide a nationwide consulting service,

allowing doctors to access the expertise of clinical toxicologists. The PIC clinical advice service aims to (i) provide reassurance where appropriate and prevent minor exposures from unnecessarily utilising ambulance, medical and hospital resources; and (ii) support optimal hospital management of higher risk exposures. PICs also undertake services such as public health and professional education, toxico-vigilance and research activities. Currently, there is no formal national organisational structure or funding for the state based PICs.

In 1987, West et al [2] investigated cost savings through community access to the NSWPIC and showed that in the absence of a PIC service, 17.8% (224) of 1257 callers would have presented to hospital and 8.8% would have presented to their General Practitioner (GP).

Since that time, there has been an increase in health costs and alternative means of accessing information, notably through the internet. The role of Australian PICs and their economic impact may have changed in the past 30 years. We aimed to undertake a study of the cost implications of Australian PICs, specifically addressing their impact on

reducing unnecessary utilisation of medical resources for benign unintentional exposures.

## Methods

### Design

The study estimated cost savings by comparing the health care services utilised by PIC callers compared with a hypothetical situation in which the service did not exist. The pattern of service use predicted for the hypothetical situation was based on two surveys administered to PIC callers.

### Data sources

#### Prospective survey of PIC callers

The New South Wales Poisons Information Centre (NSWPIC) takes approximately 50% of the nation's 205,000 poisoning calls [3]. A telephone survey (hereafter referred to as *Survey 1*) of NSWPIC callers was undertaken during a one week period from the 19/5/2017 through to 26/5/2017, surveying consecutive calls received from the public (excluding health professionals and calls originating from group homes/residential care facilities). Calls were included if they were unintentional poisoning exposures. After verbal consent was obtained, callers were asked the following open-ended question: "If you were unable to contact the poisons centre, what would you have done?" Callers nominated up to two alternate management options which were then coded into the following: call ambulance, present to hospital, call hospital, call pharmacist, call GP, present to GP, call another phone service, call friend/family, look on the internet, observe at home or other. Callers who were unable to nominate an

option were prompted with options. The least expensive management option was selected for our estimates.

We undertook a second follow up study (hereafter referred to as *Survey 2*) to determine adherence to PIC advice for unintentional exposure calls. This survey aimed to recruit at least 100 respondent cases meeting the same criteria as the initial survey between 02/10/2018 through to 03/10/2018, who agreed to a follow up call. The follow-up call was 1–3 days after the initial call, at which time they were asked: "How have you/they been since your phone call to us? What did you end up doing?" For callers who did not stay at home, they were asked a follow-up question to ascertain what triggered this action.

#### Extrapolation to 2017 calls

In 2017, PICs answered 208,906 calls with 162,584 calls relating to a new human exposure case. We examined these calls to determine the national annual number of exposures where the circumstance was unintentional.

### Data analysis

The costs of the call to the public were calculated using the following caller nominated management options. Base case estimates were based on low cost-savings assumptions. A sensitivity analysis with high cost assumptions was also undertaken (refer to [Table 1](#)).

The following assumptions were made for the base case and high cost assumptions ([Table 1](#)):

- Ambulance transport to hospital: ambulance transportation base case estimate based on NSW ambulance minimum call out fee (\$748, [4]) in addition to base case

**Table 1.** Assumptions for the base case and high cost service estimates.

Caller elected management option	Base case assumption	High cost assumption
Ambulance to hospital	Based on NSW ambulance minimum call out fee including cost to caller and private health care fund (\$748, [4]) in addition to cost of non-admitted hospital case (\$517, [7]) equating to total of \$1263.00.	Full unsubsidised cost and cost of non-admitted hospital case (as per base cost of \$1263.00) [7].
Call pharmacist	Nil cost	Community pharmacists may choose to refer to a GP, Medicare Benefits Schedule Level B consult (<20 minutes, \$37.60) [5]
Call friend/family	Nil cost	Calling a friend/family member can result in a visit to the GP, Medicare Benefits Schedule Level C consult (<40 minutes, \$71.70) [5]
Call GP	Nil cost	Calling GP may result in recommendation to present to GP, Medicare Benefits Schedule Level C consult (<40 minutes, \$71.70)[5]
Call hospital	Nil cost	Calling the hospital may result in a recommendation to present to hospital, \$517 [7]
Declined	N/A	N/A
Internet	Nil cost	Based on assumption that caller elected management option would be to stay at home hence - Nil cost
Monitor at home	Nil cost	Nil cost
Not asked	N/A	N/A
Other	N/A	N/A
Other phone service	Based on majority of calls being answered by Health Direct Australia, base case estimate is \$117.90 per call [6]	Cost of Health Direct Australia call in addition to the proportion of these calls referred to hospital (23% ([6]) multiplied by cost of non-admitted hospital case (\$517, [7]), \$236.81
Present to GP	Medicare Benefits Schedule level B consult (<20 minutes, \$37.60) [5]	Medicare Benefits Schedule level D consult (>40 minutes, \$105.50) [5]
Present to hospital	Cost of non-admitted case \$517, [7]	Cost of an entire day of hospitalisation (\$2003) [7]

estimate of non-admitted hospital case (\$517, [7]), total of \$1263. High cost assumption is as per base case estimate of \$1263.

- Call to pharmacist: base case assumption of nil cost and high cost assumption that pharmacists may refer to a GP, assumed to be a Medicare Benefits Schedule level B consult, (<20 minutes, \$37.60) [5]
- Call to friend/family: base case assumption of nil cost and high cost assumption that this can result in a visit to the GP and billed as a Medicare Benefits Schedule level C consult, (< 40 minutes, \$71.70) [5]
- Call to GP: base case assumption of nil cost and high cost assumption that GP may recommend caller to present to GP, allocated a high cost assumption of Medicare Benefits Schedule Level C, (<40 minutes, \$71.70) [5]
- Call to hospital: base case assumption of nil cost and high cost assumption that this may result in a recommendation to present to hospital, allocated cost of non-admitted hospital case of \$517 [7]
- Looking up the internet: base case and high cost assumption of nil cost based on caller electing to stay at home
- Callers advised to stay home may elect to stay home with base case and high cost assumption presumed to be nil cost
- Other phone service call cost estimate based on majority of calls being answered by Health Direct Australia, base case assumption is \$117.90 per call [6]. High cost assumption based on cost of Health Direct Australia call plus proportion of these calls referred to hospital (23% [6] multiplied by both cost of Health Direct call and cost of non-admitted hospital case (\$517, [7]), \$236.81.
- GP presentation: base case estimate assumed to be a Medicare Benefits Schedule level B consult (<20 minutes, \$37.60) and high cost estimate allocated as Medicare Benefits Schedule level D consult (>40 minutes, \$105.50) [5]
- Hospital presentation: cost of non-admitted case allocated as base case assumption (\$517, [7] and high cost estimate allocated the cost of an entire day of hospitalisation, \$2003 [7]

To calculate an approximate yearly savings value for preventing unnecessary medical resource utilisation: the proportion of calls recruited in Survey 1 versus the total number of 2017 nationwide PIC calls meeting the study criteria was examined, taking into account the compliance rate generated from Study 2. These figures were extrapolated to an overall approximate yearly savings using the call statistics from the four PICs for 2017. This was compared against the \$30 cost per PIC call [8] in order to quantify a cost saving ratio. This \$30 cost per call is from the total NSWPIC budget expenditure divided by call volume, it does not include initial investment in infrastructure, equipment and training. This approach is based on the premise that the service is well established and the question being addressed pertains to the economic case for its continued support. Data was analysed using Microsoft Excel 2013 (Microsoft Corporation, Redmond, WA; [www.microsoft.com](http://www.microsoft.com)). Ethics approval was granted by the Sydney Children's Hospitals Network Human Research Ethics Committee (reference, HREC/16/SCHN/71).

## Results

A total of 1019 calls met the eligibility criteria during the first survey period (Survey 1). Of these, 61 callers were excluded (not asked, did not understand the question or declined to participate), leaving a total of 958 responses.

Of the 958 callers surveyed (Figures 1 and 2), 31 (3.2%) would have chosen the option of ambulance transportation to the hospital had the PIC not been available and 182 (19.0%) would have opted to present to hospital (presumably without ambulance transportation).

Of the 958 callers surveyed, 867 (90.5%) were advised to stay home (Figure 1). 52 (5.4%) calls were referred to hospital, 27 calls (2.8%) were referred to the General Practitioner and 12 (1.3%) were given other management advice (Figure 1).

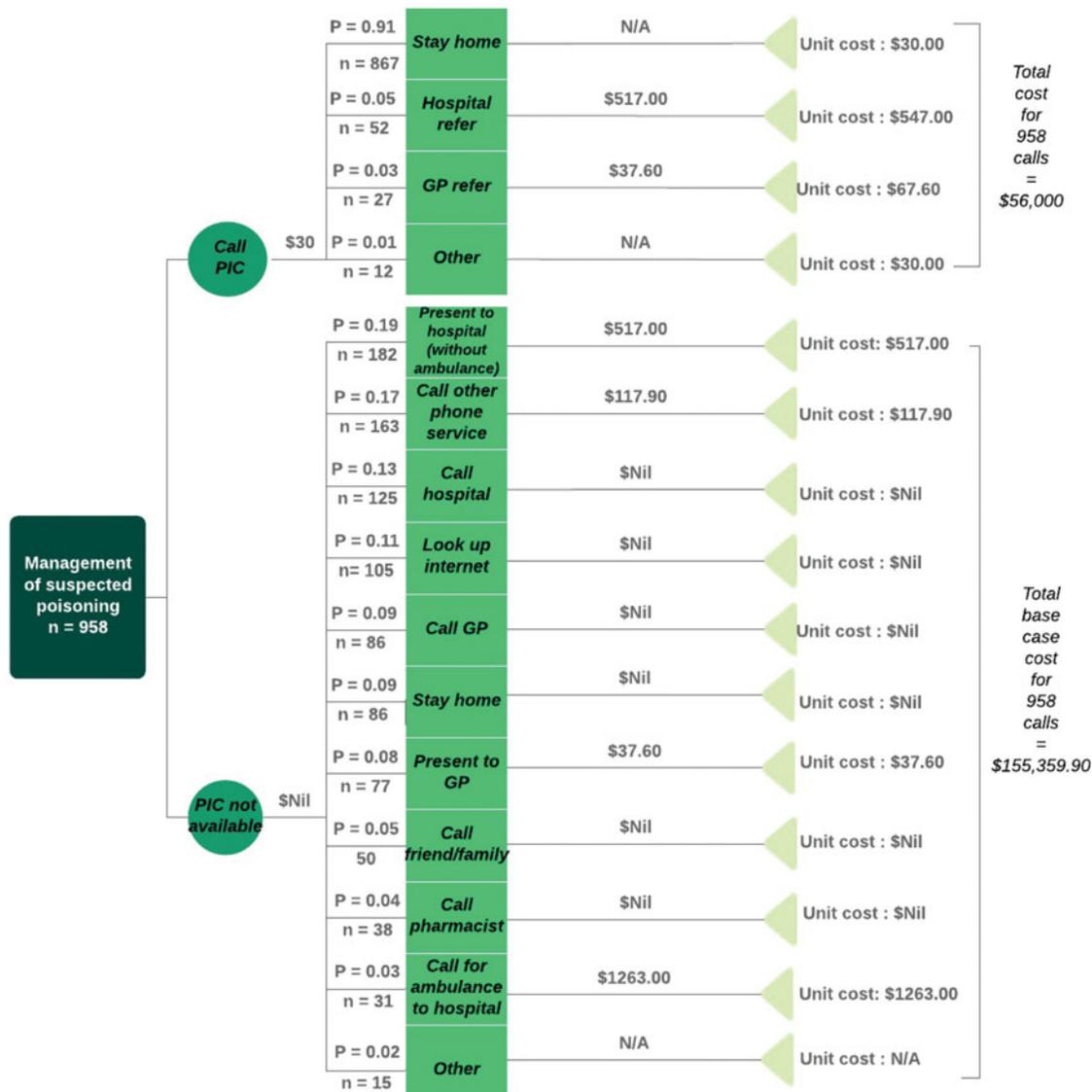
A total of 253 calls met the eligibility criteria during the second survey period (Survey 2). Of these, 137 were recruited, the remaining callers were either not asked to participate (especially if it was a busy period and caller wait time greater than 2 minutes), did not understand the question or declined to participate. Of the 137 callers recruited, 13 were lost to follow-up (9.5%). Of the 124 responses, 121 (97.6% adherence rate) callers did follow PIC advice to stay at home, 3 (2.4% CI 0.8- 6.9) callers presented to the GP as they were still anxious.

## Cost saving analysis

Analysis of the 958 calls recruited during Survey 1 using the assumptions of the lowest cost alternative and the lowest cost within each alternative yielded an estimated conservative saving of \$100,704 (Table 2). The annual total number of nationwide PIC calls meeting the study criteria was 94,913 calls (6.9% were advised to present to hospital, 86% advised to stay home), yielding an estimated conservative annual saving of \$10.1 million and savings for a high cost scenario of \$39.6 million (Table 2). The costs in the absence of the PIC are 3 to 4 (three to four-fold) higher compared to if the PIC was called (Table 2).

## Discussion

This study showed that the annual conservative estimates of cost savings for the PICs in preventing unnecessary medical resource utilisation is approximately \$10.1 million per year with a three to fourfold return on investment ratio for every dollar spent on PICs. These estimates are based upon low cost assumptions. The \$10.1 million figure is driven by people who would likely present to the emergency department or to a lesser extent GPs for low risk exposures. In the absence of the PIC, 19% of callers elected to present to the emergency department versus 5.0% of callers who did utilise the PIC (Figure 1). These findings echo the results of an American Association of Poisons Control Centres' report showing that PICs reduce unnecessary hospitalisations [9] as well as the UK National Poisons information Service's research which showed use of the UK Poisons Information



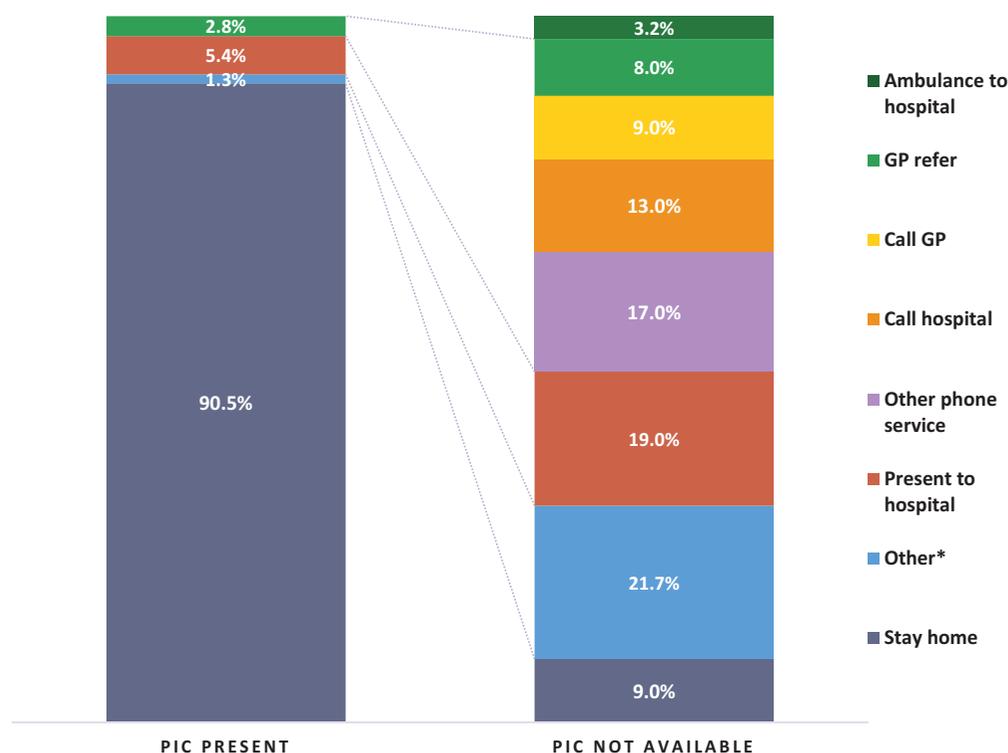
**Figure 1.** Caller decision tree for elected management of suspected poisoning calls with base case estimates for the study period (Survey 1). \*refer to Table 1 for base case cost estimate assumptions. P = probability.

Service significantly reduced ED referrals from primary healthcare services from 58.1% to 40.4% [10]. Without Poison Control Centres there would be much higher medical expenses due to callers seeking alternative more costly medical options, for instance a larger proportion of parents (44%) would present to the emergency department versus those who did utilise a PIC (1%) [9]. A systematic review has indicated that PICs in other countries are similarly economically viable with a cost benefit ratio ranging from 0.76 to 7.67 [11]. This paper only reports cost savings from PICs preventing unnecessary medical resource utilisation, there are many other areas in which PICs add value, for instance through toxico-vigilance activities, assessing poisoning risk for new drugs [12–14], adverse event detection [15], identifying unexpected and emerging hazards [16,17], or identifying emerging problems in deliberate self-poisoning [14,18].

Further cost savings could be achieved by reducing the number of unanswered calls. In 2017, 18,951 of the total 229,593 calls went unanswered. In Australian Poisons Information Centres SPIs answer up to 25 calls per SPI per

hour during busy periods. This far exceeds the international recommended standard of 8 calls/SPI/hour [1]. Presumably, the key reason for call dropouts is long waiting times for some callers; currently approximately three-quarters of calls can be answered within 1 minute, in contrast, Health Direct Australia have a performance criteria of answering 80% of calls within the first 20 seconds [19]. Increased staffing of PICs to ensure timely access and reduce call dropouts could potentially prevent further unnecessary medical utilisation and increase cost savings. In 2017, the American PICs were able to follow-up 47% of human exposure cases [20], staffing that allowed routine follow-up at a relevant time might also prevent late presentations to medical care and improve outcomes.

The total cost of running the PICs, including non-call taking activity, in the financial year 2014–2015 was \$6.5 million [8], translating to cost per call of approximately \$30. For every dollar currently invested into PIC services, there is approximately \$3.00 in cost savings generated by providing direct advice to the community (approximately \$10.1 million in annual savings). The calculated savings are based on



**Figure 2.** Management of suspected poisoning calls with PIC present versus PIC not available for study period (Survey 1). \*Other in PIC not available scenario includes: Ask pharmacist, Call friend/family, Look up internet, Other unspecified.

**Table 2.** Study period and annual base case and high costing estimates for management of unintentional exposure calls PIC calls versus alternatives chosen if no PIC.

	PIC called <sup>a</sup>	No PIC alternative
Base case cost estimate for low toxicity agent calls:		
study period calls from public ( $n = 958$ ) <sup>b</sup>	\$54,656	\$155,360
total 2017 costs for all calls from public ( $n = 94,913$ ) <sup>b^A</sup>	\$5,465,600	\$15,536,000
Annual 2017 savings estimate for base case cost estimate	\$10,070,400	
High cost estimate for low toxicity agent calls:		
study period calls from the public ( $n = 958$ ) <sup>b</sup>	\$129,822	\$526,228
total 2017 costs for all calls from public ( $n = 94,913$ ) <sup>b^A</sup>	\$12,982,200	\$52,622,800
Annual 2017 savings estimate for high cost estimate	\$39,640,600	

<sup>a</sup>using adherence rate of 97.6%.

<sup>b</sup>cost to the health care system, private health care funds (not cost of running PIC) and uninsured callers.

<sup>A</sup>calls meeting study criteria for 2017.

conservative estimates and do not include any savings from advice provided to ambulance, GPs or hospitals in the managing more serious cases or account for the benefit of freeing up hospital resources to care for other patients. Nor does it account for savings that might result from prevention of poisoning through promotional activities, e.g., social media, research and toxico-vigilance activities. It is evident that PICs currently offer a very cost effective service. In this study, we were unable to directly address whether increased investment would be offset by increased savings, or reduce the current call dropout rate however, this seems likely given the return on existing investment.

In 2016–2017, 78,302 of the total 7,755,606 presentations to emergency departments in Australia, were due to poisonings [21], representing 316 poisoning cases per 100,000 population per year [22]. Of the 78,302 emergency department presentations due to poisoning in 2016–2017, 46,268 of these presentations were not admitted [21]. Based on the estimate of \$517 per non-admitted hospital emergency presentation [7], this is approximately \$23.9 million in medical

costs associated with poisoning presentation to hospitals, it is probable that a significant proportion of the unadmitted presentations did not need to present to hospital. Further funding, promotion and utilisation of PICs could potentially reduce these unnecessary medical costs.

This study has several limitations. The data was extrapolated from NSWPIC data on 958 cases over several weeks. The proportion of hospital referrals from national data was 6.9% versus 5% in the study, however this difference would not have significantly changed the savings estimate. Such differences and over/underestimations may be due to differences in management advice between PICs, coding variations and caller elected management preferences between states and potential seasonal variation in poisonings. However, NSWPIC takes half the nation's calls and about a third originate from interstate and there is limited seasonality for non-toxic exposures such as silica gel and dishwashing detergent exposures, thus we believe this a reasonably representative sample of caller elected management options, especially for those not requiring medical care. It is possible,

that callers may have felt uncomfortable in admitting to not following PIC advice, however a university student undertook Survey-2 so this bias might have been reduced. It is possible that caller responses could have been biased through SPIs prompting the caller with more expensive alternative courses of action such as contacting emergency services, however this bias was minimised through the use of an open ended survey question and by selecting the least expensive alternative. Further, the number of callers who may have been prompted would have represented a very small proportion of the total number of recruited callers. This is not expected to significantly impact the overall result. Callers do not always identify their call as being a re-call, exposure numbers may have been overestimated, however other factors such as agent/dose/age mean most re-calls are readily identified. This study reports conservative cost savings from one core activity, which does not reflect the true cost savings of the PICs and does not account for unmeasured societal costs. These unmeasured cost savings include PICs reducing hospital length of stay, reducing patient/family costs of travel and time off work and the impact of specialist advice on patient morbidity and mortality outcomes.

There are potential benefits from further increasing PIC utilisation rates [23]. Timely medical advice to the public and to health care professionals provides health benefits, which should result in greater savings to the health care system. In the USA, barriers to PIC utilisation have included language, poverty and level of education [23]. There have not been equivalent Australian studies, but identification of barriers should facilitate development of effective strategies to increase PIC utilisation. Our study suggests that any intervention that increases PIC activities, will not only lead to the expected improvements in health, but is likely to reduce overall expenditure on poisoning within the health system.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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