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# BMJ Open

## Who teaches medical billing? A national cross-sectional survey of Australian medical education stakeholders.

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3 **Who teaches medical billing? A national cross-sectional survey of Australian medical**  
4 **education stakeholders.**  
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6  
7 Corresponding author: Margaret Faux  
8 LLB, PhD Candidate, Faculty of Health  
9 University of Technology, Sydney, Australia

10  
11 Contact details: Address: 10 Park St, Clovelly, Sydney, NSW, Australia, 2031  
12 Email: [margaret.a.faux@student.uts.edu.au](mailto:margaret.a.faux@student.uts.edu.au)  
13 Telephone: +61 414 600 073  
14 Fax: nil

15  
16 Second Author: Dr Jonathan Wardle  
17 PhD  
18 Chancellor's Research Fellow, Faculty of Health  
19 University of Technology Sydney, Australia  
20 Visiting Professor, School of Medicine, Boston University  
21 Trans-Pacific Fellow, School of Medicine, University of Washington  
22

23 Third Author: Dr Angelica G Thompson-Butel  
24 PhD  
25 Australian Catholic University, Sydney, Australia  
26

27 Fourth Author: Professor Jon Adams  
28 PhD  
29 ARC Professorial Future Fellow  
30 Professor of Public Health  
31 Director, ARCCIM, Faculty of Health  
32 University of Technology, Sydney, Australia  
33

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39 literacy.  
40 ○ Australian medical practitioners are not formally taught how to  
41 bill using Medicare.  
42 ○ Most medical educators think medical billing should be taught to  
43 medical practitioners.  
44 ○ There is no consensus on who should be responsible for teaching  
45 medical billing.  
46 ○ Medical practitioners may be incarcerated for misuse of systems  
47 they were never taught.  
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### **Contributor ship Statement**

Ms Margaret Faux - corresponding author. This paper reports the results of one phase of a three phase PhD project by Ms Faux. As such Ms Faux wrote the first draft of the paper in its entirety and has finalised all subsequent drafts incorporating the feedback and suggestions of the other authors. In addition she is responsible for the concept and design of the study, conducted all literature searches and compiled the references, prepared the tables, was involved in the data collection and analysed and interpreted the results.

Dr Jon Wardle - second author Dr Wardle is the principal supervisor for Ms Faux's Doctorate. Dr Wardle has made substantial contributions to this paper at every stage, including having involvement in the proposed concept and design of the study, through to making substantial contributions to the paper via review, critical analysis, feedback and re-drafting sections of the paper to refine important intellectual content.

Dr Angelica Thompson-Butel - third author Dr Thompson-Butel conducted the majority of the data collection and was also involved in data analysis and interpretation. She has made a substantial contribution to the content of the discussion section of the paper as a result of her close association with the data.

Professor Jon Adams - fourth author Professor Adams is the co-supervisor of Ms Faux's Doctorate. Professor Adams has made substantial contributions to later drafts of this paper via review and re-drafting of important intellectual content.

### **Data sharing statement**

Not applicable

## Abstract

**Importance:** Billing errors and healthcare fraud have been described by the World Health Organization as ‘the last great unreduced health-care cost’. Irrespective of whether healthcare systems are mature or emerging, fee-for-service or other payment types, challenges exist at the interface of medical billing and medical practice across the globe.

**Objective:** This study attempts to systematically map all avenues of medical practitioner education on medical billing in Australia, and explores the perceptions of medical education stakeholders on this topic.

**Design:** National cross-sectional survey, undertaken between April 2014 and June 2015.

**Setting:** Medical practitioners providing hospital and/or community based care in public and private sectors.

**Participants:** All organizational stakeholders involved in educating medical practitioners in relation to clinical practice (n=66), 86% response rate.

**Outcome(s) and Measure(s):** There is little medical billing education occurring in Australia. Consistent with U.S findings, Australian doctors may not have the high levels of legal and administrative literacy expected of them. Descriptive statistics via frequency distributions were used to analyze the data.

**Results:** The majority of stakeholders (70%, n=40) did not offer/have never offered, a medical billing course. Whilst 81% of stakeholders thought that medical billing should be taught to doctors, there was no consensus on who should teach it.

**Conclusions:** This original research reports the first attempt of any country to map the ways doctors obtain understanding of the legal and administrative infrastructure in which they work. Internationally, healthcare payment systems are profoundly complex. Rather than reliance on ad-hoc training, development of a national medical billing curriculum should be encouraged to improve billing compliance, expedite judicial processes, enhance program integrity and reduce waste in Australia’s healthcare system. In the absence of adequate medical billing education, disciplinary bodies in all countries must give due weight to pleas of ignorance made by doctors under investigation for incorrect billing.

### Strengths and limitations of this study

- To our knowledge this is the first study to systematically examine medical billing education of Australian medical practitioners.
- Multiple data collection methods (telephone, mail and email) may have elicited some response bias among participants, though this is likely to be negligible
- Since this study, a federal government initiative in relation to the medical education of GP's has reduced the number of vocational education providers from the 17 stakeholders included in our study to 9 stakeholders.
- Our study excluded divisions, faculties and chapters which exist under the umbrellas of the specialist medical colleges who were invited to participate, however any impact upon our results is likely to be minimal.
- This study reports findings from one country with a mixed public-private health system and a primarily fee-for-service reimbursement model and may therefore not be completely generalizable to other settings.

### Funding statement

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

### Competing interests statement.

Margaret Faux is the founder and CEO of a medical billing company, and the holder of a patent for a medical billing app.

Angelica B Thompson Butel received fees from Margaret Faux for casual work as a research assistant during the data collection phase of this project.

## Introduction

Reimbursement is a component of every encounter between a medical practitioner and a patient. From their first day of internship, medical practitioners have simultaneous and inextricably linked clinical and administrative responsibilities which form the basis upon which the license to practice medicine exists. Irrespective of the structure and design of the healthcare system, the funding arrangements in the majority of World Health Organization Member States, which facilitate reimbursements to medical practitioners, employ some form of coding system which directly or indirectly links payments and resource allocation to patient interactions.<sup>1</sup>

The complexity of coding systems, while necessary to facilitate funding arrangements, may be a contributing factor to information asymmetries in the health care market. Most patients do not understand the clinical descriptions of services itemised on their medical bills, are not in a position to question the accuracy of procedural services performed on them while they were under general anaesthesia or unconscious in an intensive care unit, and will typically have no knowledge or understanding of clinical codes. This places medical practitioners in a rare position of privilege when compared to other professionals with whom consumers may exercise more discernment regarding billing. Patients have little option other than to trust medical practitioners will not only render clinically appropriate services and treatments, but also know how to correctly itemize those services on the relevant bills and claims for reimbursement, to ensure that every health dollar is distributed appropriately.

In 2014, measurable average losses caused by fraud and incorrect payments in the world's healthcare systems was estimated at 7% of total global health expenditure, or \$487 billion (USD),<sup>2</sup> and the World Health Organization has identified financial leakage, as one of the ten leading causes of healthcare system waste globally.<sup>1</sup> In the US the improper payment rate in 2014 was estimated at 12.7% of all transactions (\$45.8 billion dollars)<sup>3</sup> and in Australia, some commentators have suggested that incorrect billing and fraud costs Australia's tax payer funded healthcare system (Medicare) 10-

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3 15% of the scheme's total cost annually (\$2-3 billion AUD).<sup>4</sup> However, the precise amount of  
4 deliberate versus unintentional misuse of the system has proven impossible to quantify in Australia  
5 and as such, the impact of alternative factors for incorrect billing beyond rorting - such as medical  
6 practitioners struggling to navigate the complex requirements of the Medicare system or inefficiencies  
7 that exist within the system itself – remains unknown.  
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14 Medical billing education has been recognised as an effective measure to improve compliance, reduce  
15 incorrect claiming and improve program integrity of health systems,<sup>5,6</sup> with countries such as the  
16 Netherlands recently introducing a requirement that universities and medical specialist training  
17 colleges provide education to medical practitioners in relation to medical billing and the costs of  
18 providing care.<sup>7</sup> However, such initiatives remain uncommon, with much of the available literature on  
19 the prevention of healthcare system waste and misuse largely ignoring education as a potentially  
20 preventive strategy, and focusing instead on sophisticated predictive modelling and data analytics,  
21 post-payment audit activity, recovery action and punitive measures, which may include  
22 disqualification from funding schemes and custodial sentences for providers.<sup>2,3,8,9,10</sup>  
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34 In both the US and Australia, evidence suggests that the medical profession itself takes a harsh view  
35 of colleagues who bill incorrectly. The medical student participants of one US study rated illegal  
36 billing as the second most egregious of 30 vignettes of misconduct, with substance abuse being  
37 reported as the most serious misconduct (86.8%), then illegal billing (69.1%), followed by sexual  
38 misconduct (50.0%).<sup>11</sup> Australian medical practitioners have also been highly critical of colleagues  
39 who bill incorrectly<sup>12</sup> and the Medical Board of Australia recognises the importance of medical billing  
40 compliance by requiring certain medical practitioners to sign a legally binding declaration confirming  
41 the practitioner has taught key aspects of the operation of Australia's Medicare system, including  
42 funding arrangements, to colleagues, it thus being a requirement that assumes prior learning of the  
43 Medicare system by medical practitioners.<sup>13</sup> However, in Australia we currently do not know how,  
44 when or where this learning occurs.  
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3 The US federal government has adopted a view that publications produced by Medicare  
4 Administrative Contractors, the Centres for Medicare and Medicaid Services, and Explanation of  
5 Benefits Remittance Statements are adequate education for physicians.<sup>14</sup> However, a small body of  
6 international research on the topic (mostly undertaken in the US) suggests medical billing literacy  
7 amongst physicians is low.<sup>15,16</sup> This may provide some explanation as to why the financial cost of  
8 healthcare system misuse continues to be a pressing challenge for all countries.<sup>1,2</sup>  
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16 US research on the topic of medical practitioner knowledge of correct medical billing is generally  
17 more mature than other jurisdictions, and has resulted in suggestions that medical billing training  
18 should be viewed as a core competency of medical training, and a national medical billing curriculum  
19 should be developed.<sup>16</sup> Australian literature reveals no formal medical billing curriculum and, with the  
20 exception of a relatively small, rudimentary and non-mandatory selection of brief online learning  
21 materials,<sup>17</sup> only one government approved certificate course regarding medical billing exists.<sup>18</sup>  
22 However, this course is not designed for medical practitioners, but for medical receptionists, who are  
23 not legally responsible for the claims they submit on behalf of medical practitioners.<sup>19</sup>  
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34 Despite increasing pressure on medical practitioners in relation to billing compliance both  
35 internationally<sup>2,7</sup> and in Australia,<sup>9,20</sup> there has been scant research attention on training medical  
36 practitioners regarding correct medical billing. In response to the dearth of research in this area, this  
37 study attempts to systematically map all formal avenues of medical practitioner education on  
38 Medicare claiming and compliance in Australia, and explores the perceptions of medical education  
39 stakeholders on the teaching of medical billing in Australia.  
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## 48 **Methods**

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50 A national cross-sectional survey of all major Australian organizational stakeholders (n=66) who play  
51 a role in the education of medical practitioners in relation to clinical practice was undertaken between  
52 April 2014 and June 2015. The survey framed questions around the concept of a 'medical billing  
53 course', the definition of which was intentionally broad to include any content whatsoever on the  
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3 specific topic of claiming and compliance under the Medicare Benefits Schedule (MBS).<sup>21</sup> The  
4 questions focused on course availability, as well as views on whether the topic should be taught and  
5 who should be responsible for delivery, the duration of courses offered, the qualifications of relevant  
6 teachers, whether courses were voluntary or mandatory, free or paid, and methods of assessment with  
7 regard to certification. Participants responded to a maximum of 15 questions with the final question  
8 being reserved for the government stakeholder group. This final question asked where medical  
9 practitioners who have been found to have breached Medicare's requirements are directed to learn  
10 how to bill correctly. The survey was designed as a telephone survey however the majority of  
11 stakeholders requested an emailed copy prior to agreeing to participate. Descriptive statistics via  
12 frequency distributions were used to analyse the data. The study was approved by the Human  
13 Research Ethics Committee of the University of Technology Sydney (HREC 2014000060).  
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## 26 **Results**

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28 The response rate was 86% (n=57), with 32 respondents (who represented stakeholder organizations)  
29 choosing to complete the survey manually by mail and email, and 25 were completed by telephone.  
30 Characteristics of the stakeholders are presented in Table 1, together with the details of providers of  
31 medical billing courses in Australia.  
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### 38 Medical billing course delivery and content

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40 The majority of stakeholders (70%, n=40) did not offer, and have never offered, a medical billing  
41 course. Of those stakeholders (30%, n=17) who did provide courses regarding medical billing for  
42 medical practitioners, the majority (71%, n=12) were vocational education providers facilitating  
43 postgraduate training exclusively to general practitioners (GPs). The majority of stakeholders who  
44 provided courses (76%, n=13) did so as a mandatory component of an induction and introduction  
45 program. Most course providers (59%, n=10) reported a course duration of less than two hours and  
46 almost all providers of medical billing courses (94%, n=16) stated that the course was delivered by a  
47 person with medical qualifications, some of whom also had educational qualifications. The majority  
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3 of medical billing course providers (82%, n=14) did not include assessment as part of their course and  
4 almost all medical billing course providers (94%, n=16) provided the course free of charge.  
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9 Two government agencies responded to question 15, which asked where medical practitioners who  
10 have been found to have breached Medicare's requirements are directed to learn how to bill correctly  
11 for their services. One stated that no direction is given to medical practitioners who have been found  
12 to have breached Medicare's requirements, and the other stated that medical practitioners who have  
13 been found to have breached Medicare's requirements would be referred to Medicare to further their  
14 learning in the area.  
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### 22 Perceptions on who should provide medical billing education

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24 Table 2 shows stakeholder perceptions regarding medical billing courses. Of the 40 stakeholders who  
25 did not offer a medical billing course, nearly three-quarters (72%, n=29) thought that someone should  
26 provide a medical billing course for medical practitioners. Five respondents who stated that they did  
27 not think a medical billing course for medical practitioners was necessary nevertheless went on to  
28 suggest who they thought should deliver a medical billing course. The majority of respondents who  
29 did not think that a course was required were from undergraduate university medical schools and  
30 postgraduate specialist medical colleges. Most respondents who did not offer a medical billing course  
31 (85%, n=34) offered a view as to who should be responsible for teaching such a course, and the  
32 majority (82% n=28) stated Medicare.  
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### 44 **Discussion**

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46 Our study identified broad agreement amongst medical education stakeholders that medical billing  
47 should be taught to medical practitioners at some point in their careers. However, there appears to be  
48 no consensus amongst the stakeholders on where, when or how this should occur.  
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54 Although most Australian medical education stakeholders in our study perceived the topic as  
55 important, most do not believe medical billing education falls within the scope of their own  
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3 organizational responsibilities with respect to educating medical practitioners. All respondents  
4 suggested other parties should be responsible for delivering medical billing courses to medical  
5 practitioners. However, the stakeholder organizations who were nominated by other stakeholders as  
6 having responsibility for teaching medical billing to medical practitioners did not necessarily agree  
7 that this responsibility should fall with them. For example, the Australian Medical Association and the  
8 specialist colleges were among those most commonly selected to deliver courses, yet the nominated  
9 organizations themselves did not agree that this fell within their scope.  
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18 Undergraduate university medical schools and postgraduate specialist medical colleges were the  
19 major category of respondents who did not think that a specific course on medical billing was  
20 required. University stakeholders reported a general consensus that Medicare billing was of no  
21 immediate relevance to undergraduate students, citing crowded curriculums and the need to prioritise  
22 clinical content over content concerning reimbursement after graduates join the workforce. Some  
23 specific postgraduate specialist colleges stated that any Medicare billing education should occur  
24 informally on an ad hoc basis during internship whenever relevant learning opportunities arise.  
25 However, some postgraduate specialist colleges describe 'questionable' medical billing as unethical  
26 behaviour in their professionalism training modules,<sup>22</sup> yet training provided to their members may not  
27 include specific content on how to bill correctly.  
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40 The lack of qualified educators in this area is also potentially problematic. Our survey reveals that  
41 where medical billing education does exist in Australia, it is provided by medical practitioners, rather  
42 than educators with qualifications or expertise in the administrative and legal aspects of Medicare. As  
43 such, our research suggests the training received by Australian medical practitioners regarding correct  
44 medical billing may be highly variable. One possible implication of this variability is that medical  
45 practitioners may inadvertently fall into non-compliance with Medicare's requirements, for which  
46 possible sanctions can include criminal liability.<sup>23</sup> This is a finding that mirrors concerns raised in the  
47 US, where research has shown that teaching around medical billing to medical practitioners is highly  
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3 variable and dependent on the expertise, experience and the confidence of senior mentors, many of  
4 whom may themselves have had little training in the area.<sup>16</sup>  
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9 Our study reveals some initiatives by independent organizations to create their own learning modules  
10 on medical billing for medical practitioners in lieu of more formal education. However significant  
11 gaps exist. For example, many vocational education providers described their medical billing courses  
12 as being practical ‘on-the-job’ training programs delivered during placement in GP practices. Yet  
13 such programs did not include specific curriculum content, learning outcomes or formal assessment of  
14 correct Medicare billing. The few courses which were offered by specialist medical colleges consisted  
15 of little more than voluntary attendance at a short presentation, and one stakeholder offered only  
16 optional reading of articles specific to Medicare billing. Whilst these efforts are commendable, the  
17 average course length of less than two hours is unlikely to achieve the high level of legal and  
18 administrative literacy that is expected of medical practitioners working within a complex system of  
19 nearly 6000 reimbursement items, over 900 A4 pages of service descriptions, complex cross-  
20 referencing and rules and in which a single service can be the subject of up to 30 payment rates, with  
21 strict penalties for incorrect claiming.<sup>24</sup>  
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36 Our analyses show most medical billing education initiatives tend to focus on general practice and  
37 educating GPs. Medical specialists - who represent both the majority of Australian registered medical  
38 practitioners<sup>25</sup> and account for the majority of total Medicare expenditure<sup>26</sup> – appear to receive almost  
39 no training in this area (with those few specialist organizations who do offer such content to their  
40 members offering it exclusively on a voluntary basis). This finding has particular significance given  
41 most specialists engage in hospital-based medical billing which, in Australia, has profound  
42 complexity.<sup>19,27</sup> It is also noteworthy that our research suggests medical practitioners who are found to  
43 have breached Medicare’s requirements are given no guidance to help improve their medical billing  
44 compliance. One government stakeholder stated that offenders would be referred to Medicare to  
45 further their learning in this area, but it is not clear whether Medicare in fact offers remedial medical  
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3 billing training. Lack of formal medical billing education for those who have already been found to  
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5 have breached Medicare's requirements may increase the potential for recidivism.  
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9 Examining the knowledge and educational needs of medical practitioners around medical billing is  
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11 also important because proving criminal intent to defraud is not necessarily a requirement when  
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13 prosecuting practitioners for incorrect billing.<sup>10,12,28</sup> Relevant case law reveals that when faced with  
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15 criminal charges of medical billing fraud, medical practitioners in both Australia and the US have  
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17 entered pleas of ignorance in their defence.<sup>23,29</sup> Whilst such pleas have been unsuccessful in  
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19 preventing conviction, the findings of our study suggest there may sometimes be veracity in  
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21 submissions made by medical practitioners that they did not know the conduct for which they stand  
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23 accused was wrong. Until such time as governments can confidently assert and demonstrate that  
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25 medical practitioners are fully cognizant of their medical billing responsibilities, procedural fairness  
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27 for medical practitioners under investigation may be denied, and the defence of ignorance will always  
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29 remain – at least theoretically – open.  
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32 The majority of medical education stakeholders in our study expressed the view that Australia's  
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34 national universal insurer - Medicare - had sole responsibility for developing a standardised course  
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36 and teaching correct medical billing to medical practitioners. Currently this is neither supported by the  
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38 relevant legislation nor the administrative structure of Medicare.<sup>19,30</sup> However, as custodians of public  
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40 money, national insurers such as Medicare in Australia do have an overarching responsibility to  
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42 ensure that any medical practitioner in the privileged position of being able to access taxpayer funded  
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44 reimbursements is equipped to do so correctly from their first day of registration. Medicare itself has  
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46 identified medical billing education as one area in which significant improvements can be made, both  
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48 in terms of increasing compliance and reducing expenditure.<sup>6</sup> Abrogation of this responsibility to  
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50 market forces, medical practitioners themselves, industrial organizations or other medical education  
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52 stakeholders is not only ineffective, but may no longer be tenable in the current climate of pressured  
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54 health budgets and public expectations.  
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### Limitations

To our knowledge this is the first study to systematically examine medical billing education of Australian medical practitioners. However, there are some limitations that need to be considered when interpreting our study findings. Multiple data collection methods (telephone, mail and email) may have elicited some response bias among participants, though this is likely to be negligible given the exploratory and descriptive nature of this study. Also, since this study, a federal government initiative in relation to the medical education of GP's has reduced the number of vocational education providers from the 17 stakeholders included in our study to 9 stakeholders.<sup>31</sup> Further, our study excluded divisions, faculties and chapters which exist under the umbrellas of the specialist medical colleges who were invited to participate. However, any impact upon our results is likely to be minimal due to the small numbers of medical practitioners involved and the focus of such divisions, faculties and chapters on clinical education, policy development and advocacy, rather than the administrative aspects of medical practice.

Whilst this study focused on formal offerings by medical education stakeholders, further research is also required to explore whether medical practitioners are self-educating or sourcing non-traditional education on Medicare billing and compliance, thereby achieving the high expected levels of medical billing literacy expected of them.

This study reports findings from one country with a mixed public-private health system and a primarily fee-for-service reimbursement model and may therefore not be completely generalizable to other settings. Nevertheless, irrespective of whether health care systems are mature or emerging, challenges appear to exist at the interface of medical billing and payment system complexity, and medical practice across multiple health settings. Increasing private sector involvement in the 65-year-old, single public payer, capitation styled NHS of the United Kingdom has exposed compliance vulnerabilities,<sup>2,32</sup> and in a starkly different healthcare system with multiple, private payers, and a blend of capitation, fee-for-service and salary payment arrangements, the Netherlands has reported similar challenges.<sup>7</sup> Commentary on Indonesia's nascent universal healthcare system BPJS (Badan

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2  
3 Penyelenggara Jaminan Sosial Kesehatan), which uses a mixed capitation and fee-for-service model  
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5 has already described the challenges of medical practitioner compliance under the new scheme,<sup>33</sup> and  
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7 some commentators have suggested that no healthcare system is exempt from billing errors and  
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9 fraud.<sup>8</sup> As such our results may offer insights for regulators, policy-makers and practitioners beyond  
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11 the Australian setting.

## 12 13 14 15 **Conclusion**

16  
17 Our study found that very little proactive education aimed at improving medical billing compliance by  
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19 medical practitioners is currently occurring or has ever occurred in Australia, and available medical  
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21 billing education is highly variable and may not deliver the level of expected legal and administrative  
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23 literacy required to effectively and competently use the national insurance scheme and ensure  
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25 program integrity. This is consistent with findings in the US where it has been suggested that  
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27 clinicians need to be properly prepared to practice medicine beyond clinical encounters to reduce the  
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29 incidence of potentially serious administrative errors. In the absence of adequate medical billing and  
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31 payment system education for medical practitioners, relevant courts in all countries must give due  
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33 consideration to pleas of ignorance made by medical practitioners facing criminal charges related to  
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35 incorrect medical billing, which may sometimes be legitimate. Rather than reliance on ad-hoc training  
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37 and education, development of a formal national medical billing curriculum for medical practitioners  
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39 should be encouraged to improve billing compliance, expedite judicial processes, enhance program  
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41 integrity and reduce wasted resources in the health system.



**Table 1:** Characteristics and details of providers of medical billing course (MBC) in Australia

Stakeholder description	Invited	Responded	Offer MBC (% of respondents)	Do not offer MBC
Undergraduate education (University medical schools)	18	17	1 (6%)	16
Postgraduate general practitioner education (Vocational education providers)	17	15	12 (80%)	3
Postgraduate specialist education (Specialist medical colleges)	16	14	2 (14%)	12
Representative professional organizations (State and territory branches of the Australian Medical Association (AMA))	8	5	0 (0%)	5
Medical defence organizations (also known as medical indemnity insurers)	4	4	2 (50%)	2
Government agencies and departments (Australian Health Practitioner Regulation Agency, Professional Services Review Agency and Medicare)	3	2	0 (0%)	2
<b>TOTAL</b>	<b>n = 66</b>	<b>n = 57 (86%)</b>	<b>n = 17 (30%)</b>	<b>n = 40 (70%)</b>

**Table 2:** Stakeholder perceptions on who should provide medical billing education\*

Suggested providers of medical billing courses	Those who felt medical billing should be taught (85% of respondents n=29) suggested the following stakeholders should teach it	Those who felt medical billing should not be taught (15% of respondents n=5) but still suggested who should teach it	Total who responded (n=34)
Medicare	24	4	28
Australian Medical Association	6	1	7
Specialist Colleges	5	1	6
Medical Boards	4	0	4
Universities	3	0	3
Medical Defence Organizations	3	0	3
Vocational training providers	2	0	2
Private health funds	1	1	2
Total no. suggestions	48	7	55

\* 34 stakeholders who did not provide their own medical billing courses responded to this question. They comprise 29 positive responses to the question: "Do you think doctors should be taught medical billing?" and 5 negative responses who went on to suggest training providers. Many chose more than one stakeholder when responding.

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# BMJ Open

## Who teaches medical billing? A national cross-sectional survey of Australian medical education stakeholders

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3 **Who teaches medical billing? A national cross-sectional survey of Australian medical**  
4 **education stakeholders.**  
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7 Corresponding author: Margaret Faux  
8 LLB, PhD Candidate, Faculty of Health  
9 University of Technology, Sydney, Australia

10  
11 Contact details: Address: 10 Park St, Clovelly, Sydney, NSW, Australia, 2031  
12 Email: [margaret.a.faux@student.uts.edu.au](mailto:margaret.a.faux@student.uts.edu.au)  
13 Telephone: +61 414 600 073  
14 Fax: nil

15  
16 Second Author: Dr Jonathan Wardle  
17 PhD  
18 Senior Lecturer, Faculty of Health  
19 University of Technology Sydney, Australia  
20 Visiting Professor, School of Medicine, Boston University  
21 Trans-Pacific Fellow, School of Medicine, University of Washington  
22

23 Third Author: Dr Angelica G Thompson-Butel  
24 PhD  
25 Lecturer, Faculty of Health Sciences  
26 Australian Catholic University, Sydney, Australia  
27

28 Fourth Author: Professor Jon Adams  
29 PhD  
30 ARC Professorial Future Fellow  
31 Professor of Public Health  
32 Director, ARCCIM, Faculty of Health  
33 University of Technology, Sydney, Australia  
34

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### **Contributorship Statement**

Ms Margaret Faux - corresponding author. This paper reports the results of one phase of a three phase PhD project by Ms Faux. As such Ms Faux wrote the first draft of the paper in its entirety and has finalised all subsequent drafts incorporating the feedback and suggestions of the other authors. In addition she is responsible for the concept and design of the study, conducted all literature searches and compiled the references, prepared the tables, was involved in the data collection and analysed and interpreted the results.

Dr Jon Wardle - second author Dr Wardle is the principal supervisor for Ms Faux's Doctorate. Dr Wardle has made substantial contributions to this paper at every stage, including having involvement in the proposed concept and design of the study, through to making substantial contributions to the paper via review, critical analysis, feedback and re-drafting sections of the paper to refine important intellectual content.

Dr Angelica Thompson-Butel - third author Dr Thompson-Butel conducted the majority of the data collection and was also involved in data analysis and interpretation. She has made a substantial contribution to the content of the discussion section of the paper as a result of her close association with the data.

Professor Jon Adams - fourth author Professor Adams is the co-supervisor of Ms Faux's Doctorate. Professor Adams has made substantial contributions to later drafts of this paper via review and re-drafting of important intellectual content.

### **Data sharing statement**

We do not see data sharing as relevant to this study, however the deidentified results are available to researchers having an interest in this area. Please contact the corresponding author by email to make enquiries.

## Abstract

**Importance:** Billing errors and healthcare fraud have been described by the World Health Organization as ‘the last great unreduced health-care cost’. Estimates suggest 7% of global health expenditure (\$487 billion USD) is wasted from this phenomenon. Irrespective of different payment models, challenges exist at the interface of medical billing and medical practice across the globe. Medical billing education has been cited as an effective preventative strategy, with targeted education saving \$250 million in Australia in one year from an estimated \$1-3 billion of waste.

**Objective:** This study attempts to systematically map all avenues of medical practitioner education on medical billing in Australia and explores the perceptions of medical education stakeholders on this topic.

**Design:** National cross-sectional survey between April 2014 and June 2015. No patient or public involvement.

**Participants:** All stakeholders who educate medical practitioners regarding clinical practice (n=66), 86% responded.

**Outcome(s) and Measure(s):** There is little medical billing education occurring in Australia. Consistent with U.S findings, Australian doctors may not have expected legal and administrative literacy. Data analysis - descriptive statistics via frequency distributions.

**Results:** The majority of stakeholders (70%, n=40) did not offer/have never offered, a medical billing course. 89% thought medical billing should be taught, including 30% (n=17) who were already teaching it. There was no consensus on where, when or how medical billing education should occur.

**Conclusions:** To our knowledge, this is the first attempt of any country to map the ways doctors learn the complex legal and administrative infrastructure in which they work. Rather than reliance on ad-hoc training, development of an Australian medical billing curriculum should be encouraged to improve compliance, expedite judicial processes and reduce waste. In the absence of adequate education, disciplinary bodies in all countries must consider pleas of ignorance by doctors under investigation, where appropriate, for incorrect medical billing.



### Strengths and limitations of this study

- Despite medical billing errors and fraud being a significant problem, and education having been proven as an effective preventative strategy, to our knowledge this is the first study which has attempted to systematically map medical billing education of Australian medical practitioners.
- Multiple data collection methods (telephone, mail and email) may have elicited some response bias among participants, though this is likely to be negligible
- Since this study, federal government initiatives in relation to the medical education of General Practitioners (GP) has reduced the number of GP post-graduate training providers (referred to in Australia as vocational education providers) from the 17 stakeholders included in our study to 11 stakeholders.
- Our study excluded divisions, faculties and chapters which exist under the umbrellas of the specialist medical colleges who were invited to participate, however any impact upon our results is likely to be minimal.
- This study reports findings from one country with a mixed public-private health system and a primarily fee-for-service reimbursement model and may therefore not be completely generalizable to other settings.

### Funding statement

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### Competing interests statement.

Margaret Faux is the founder and CEO of a medical billing company, and the holder of a patent for a medical billing app.

Angelica G Thompson-Butel received fees from Margaret Faux for casual work as a research assistant during the data collection phase of this project.

## Introduction

Reimbursement is a component of every encounter between a medical practitioner and a patient. From their first day of internship, medical practitioners have simultaneous and inextricably linked clinical and administrative responsibilities which form the basis upon which the license to practice medicine exists. The funding arrangements in the majority of countries which facilitate reimbursements to medical practitioners, employ some form of classification system which directly or indirectly links payments and resource allocation to patient interactions.<sup>1</sup>

The complexity of health classification systems, such as the international classification of diseases (ICD), while necessary to facilitate funding arrangements, may be a contributing factor to information asymmetries in the health care market. Whilst some initiatives and recommendations have attempted to minimise the specific impact of financial information asymmetry on healthcare costs, it remains a significant problem.<sup>2,3</sup> Most patients do not understand the clinical descriptions of services itemised on their medical bills, are not in a position to question the accuracy of procedural services performed on them while they were under general anaesthesia or unconscious in an intensive care unit, and will typically have no knowledge or understanding of ICD and billing codes which may operate in their jurisdictions. This places medical practitioners in a rare position of privilege when compared to other professionals and service providers with whom consumers may exercise more discernment and question anomalies on their bills. Patients have little option other than to trust medical practitioners will not only render clinically appropriate services and treatments, but also know how to correctly itemize those services on the relevant bills and claims for reimbursement, because all decisions regarding the contents of medical bills are made unilaterally by the medical practitioner, in accordance with her determination of clinical need.

In 2014, measurable average losses caused by fraud and incorrect payments in the world's healthcare systems was estimated at 7% of total global health expenditure, or \$487 billion (USD),<sup>4</sup> and the World Health Organization has identified financial leakage, as one of the ten leading causes of

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3 healthcare system waste globally.<sup>1</sup> In Australia, some commentators have suggested that incorrect  
4 billing and fraud costs Australia's tax payer funded healthcare system (Medicare) 10-15% of the  
5 scheme's total cost annually (\$2-3 billion AUD).<sup>5</sup> However, the precise amount of deliberate versus  
6 unintentional misuse of the system has proven impossible to quantify in Australia and as such, the  
7 impact of alternative factors for incorrect billing beyond reporting - such as medical practitioners  
8 struggling to navigate the complex requirements of the Medicare system or inefficiencies that exist  
9 within the system itself – remains unknown. However, the lack of clarity around underpinning  
10 legislation and regulation has been identified by many medical practitioners as an important issue, one  
11 that often has significant professional consequences.<sup>6,7</sup>

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23 Medical billing education has been recognised as an effective measure to improve compliance, reduce  
24 incorrect claiming and improve program integrity of health systems,<sup>8,9</sup> with countries such as the  
25 Netherlands recently introducing a requirement that universities and medical specialist training  
26 colleges provide education to medical practitioners in relation to medical billing and the costs of  
27 providing care.<sup>10</sup> However, such initiatives remain uncommon, with much of the available literature  
28 on the prevention of healthcare system waste and misuse largely ignoring education as a potentially  
29 preventive strategy, and focusing instead on sophisticated predictive modelling and data analytics,  
30 post-payment audit activity, recovery action and punitive measures, which may include  
31 disqualification from funding schemes and custodial sentences for providers.<sup>4,6,11,12,13</sup>

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42 In both the U.S and Australia, evidence suggests that the medical profession itself takes a harsh view  
43 of colleagues who bill incorrectly. The medical student participants of one U.S study rated illegal  
44 billing as the second most egregious of 30 vignettes of misconduct, with substance abuse being  
45 reported as the most serious misconduct (86.8%), then illegal billing (69.1%), followed by sexual  
46 misconduct (50.0%).<sup>14</sup> Australian medical practitioners have also been highly critical of colleagues  
47 who bill incorrectly<sup>15</sup> and the Medical Board of Australia recognises the importance of medical billing  
48 compliance by requiring certain medical practitioners to sign a legally binding declaration confirming  
49 the practitioner has taught key aspects of the operation of Australia's Medicare system, including  
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3 funding arrangements, to colleagues, it thus being a requirement that assumes prior learning of the  
4 Medicare system by medical practitioners.<sup>16</sup> However, in Australia we currently do not know how,  
5 when or where this learning occurs.  
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10 The U.S federal government has adopted a view that publications produced by Medicare  
11 Administrative Contractors, the Centres for Medicare and Medicaid Services, and Explanation of  
12 Benefits Remittance Statements are adequate education for physicians.<sup>17</sup> However, a small body of  
13 international research on the topic (mostly undertaken in the U.S) suggests medical billing literacy  
14 amongst physicians is low.<sup>18,19</sup> This may provide some explanation as to why the financial cost of  
15 healthcare system misuse continues to be a pressing challenge in many countries.<sup>1,4</sup>  
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24 U.S research on the topic of medical practitioner knowledge of correct medical billing is generally  
25 more mature than other jurisdictions, and has resulted in suggestions that medical billing training  
26 should be viewed as a core competency of medical training, and a national medical billing curriculum  
27 should be developed.<sup>18</sup> Australian literature reveals no formal medical billing curriculum and, with the  
28 exception of a relatively small, rudimentary and non-mandatory selection of brief online learning  
29 materials,<sup>20</sup> only one government approved certificate course regarding medical billing exists.<sup>21</sup>  
30 However, this course is not designed for medical practitioners, but for medical receptionists, who are  
31 not legally responsible for the bills they submit on behalf of medical practitioners.<sup>22</sup>  
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42 There is increasing pressure on medical practitioners in relation to billing compliance  
43 internationally<sup>4,10</sup>. It has also been identified as an issue in Australia,<sup>12,23</sup> where the medical billing  
44 system is divorced from clinical designations (such as the ICD) and a single medical service  
45 can be the subject of over 30 different fees, rules and penalties<sup>7</sup>. There have been suggestions  
46 education may improve billing literacy,<sup>9</sup> yet there has been scant research attention on training  
47 medical practitioners regarding correct medical billing. In response to the dearth of research in this  
48 area, this study attempts to systematically map all avenues of medical practitioner education on  
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3 Medicare billing and compliance in Australia, and explores the perceptions of medical education  
4 stakeholders on the teaching of medical billing in Australia, to inform appropriate policy and  
5 regulatory initiatives.  
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## 10 **Methods**

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12 A national cross-sectional survey of all Australian organizational stakeholders (n=66) who play a role  
13 in the education of medical practitioners from their first day as medical students through to the end of  
14 their careers, in relation to clinical practice, was undertaken between April 2014 and June 2015. A  
15 copy of the survey is included as a supplementary file. The survey framed questions around the  
16 concept of a 'medical billing course', the definition of which was intentionally broad to include any  
17 content whatsoever on the specific topic of medical billing and compliance under Australia's unique  
18 classification system known as the Medicare Benefits Schedule (MBS), which unlike many other  
19 health systems, has no relationship with ICD codes.<sup>24</sup> The questions focused on course availability, as  
20 well as views on whether the topic should be taught and who should be responsible for delivery, the  
21 duration of courses offered, the qualifications of relevant teachers, whether courses were voluntary or  
22 mandatory, free or paid, and methods of assessment with regard to certification. Participants  
23 responded to a maximum of 15 questions with the final question being reserved for the government  
24 stakeholder group. This final question asked where medical practitioners who have been found to  
25 have breached Medicare's requirements are directed to learn how to bill correctly. The survey was  
26 designed as a telephone survey however the majority of stakeholders requested an emailed copy prior  
27 to agreeing to participate. Our study excluded divisions, faculties and chapters which exist under the  
28 umbrellas of the specialist medical colleges who were invited to participate. Some professional  
29 stakeholders were Australasian in nature (Australasia is a term for Australia, New Zealand and  
30 occasionally the Pacific Islands) and we excluded those organisations focussed primarily on New  
31 Zealand. Descriptive statistics via frequency distributions were used to analyse the data. The study  
32 was approved by the Human Research Ethics Committee of the University of Technology Sydney  
33 (HREC 2014000060) and no patients or public were involved.  
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## Results

The response rate was 86% (n=57), with 32 respondents (who represented stakeholder organizations) choosing to complete the survey manually by mail and email, and 25 were completed by telephone. Characteristics of the stakeholders are presented in Table 1, together with the details of providers of medical billing courses in Australia.

### Medical billing course delivery and content

The majority of stakeholders (70%, n=40) did not offer, and have never offered, a medical billing course. Of those stakeholders (30%, n=17) who did provide courses regarding medical billing for medical practitioners, the majority (71%, n=12) were vocational education providers facilitating postgraduate training exclusively to general practitioners (GPs). The majority of stakeholders who provided courses (76%, n=13) did so as a mandatory component of an induction and introduction program. Most course providers (59%, n=10) reported a course duration of less than two hours and almost all providers of medical billing courses (94%, n=16) stated that the course was delivered by a person with medical qualifications, some of whom also had educational qualifications. The majority of medical billing course providers (82%, n=14) did not include assessment as part of their course and almost all medical billing course providers (94%, n=16) provided the course free of charge. These results are presented in table 2.

Two government agencies responded to question 15, which asked where medical practitioners who have been found to have breached Medicare's requirements are directed to learn how to bill correctly for their services. One stated that no direction is given to medical practitioners who have been found to have breached Medicare's requirements, and the other stated that medical practitioners who have been found to have breached Medicare's requirements would be referred to Medicare to further their learning in the area.

### Perceptions on who should provide medical billing education

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3 Table 3 shows stakeholder perceptions regarding medical billing courses. 89% of stakeholders  
4 thought that medical billing should be taught to medical practitioners, including 30% (n=17) who  
5 were already teaching it. Of the 40 stakeholders who did not offer a medical billing course, nearly  
6 three-quarters (72%, n=29) thought that someone should provide a medical billing course for medical  
7 practitioners. Five respondents who stated that they did not think a medical billing course for medical  
8 practitioners was necessary nevertheless went on to suggest who they thought should deliver a  
9 medical billing course. The majority of respondents who did not think that a course was required were  
10 from undergraduate university medical schools and postgraduate specialist medical colleges. Most  
11 respondents who did not offer a medical billing course (85%, n=34) offered a view as to who should  
12 be responsible for teaching such a course, and the majority (82% n=28) stated Medicare.  
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## 24 **Discussion**

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26 Our study identified broad agreement amongst medical education stakeholders that medical billing  
27 should be taught to medical practitioners at some point in their careers. However, there appears to be  
28 no consensus amongst the stakeholders on where, when or how this should occur.  
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34 Although most Australian medical education stakeholders in our study perceived the topic as  
35 important, most do not believe medical billing education falls within the scope of their own  
36 organizational responsibilities with respect to educating medical practitioners. All respondents  
37 suggested other parties should be responsible for delivering medical billing courses to medical  
38 practitioners. However, the stakeholder organizations who were nominated by other stakeholders as  
39 having responsibility for teaching medical billing to medical practitioners did not necessarily agree  
40 that this responsibility should fall with them. For example, the Australian Medical Association and the  
41 specialist colleges were among those most commonly selected to deliver courses, yet the nominated  
42 organizations themselves did not agree that this fell within their scope.  
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54 Undergraduate university medical schools and postgraduate specialist medical colleges were the  
55 major category of respondents who did not think that a specific course on medical billing was  
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3 required. This finding directly contrasts with international views. The opposite view appears to be  
4 held by these two stakeholder groups in The Netherlands for example, where university medical  
5 schools and postgraduate specialist medical colleges have been tasked with providing training on  
6 medical billing and the costs of providing care to medical practitioners in that country.<sup>10</sup> University  
7 stakeholders reported a general consensus that Medicare billing was of no immediate relevance to  
8 undergraduate students, citing crowded curriculums and the need to prioritise clinical content over  
9 content concerning reimbursement after graduates join the workforce. Some specific postgraduate  
10 specialist colleges stated that any Medicare billing education should occur informally on an ad hoc  
11 basis during internship whenever relevant learning opportunities arise. However, we found that some  
12 postgraduate specialist colleges describe 'questionable' medical billing as unethical behaviour in their  
13 professionalism training modules,<sup>25</sup> yet training provided to their members may not include specific  
14 content on how to bill correctly.

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28 The lack of qualified educators in this area is also potentially problematic. Our survey reveals that  
29 where medical billing education does exist in Australia, it is provided largely by medical practitioners,  
30 rather than educators with qualifications or expertise in the administrative and legal aspects of  
31 Medicare. As such, our research suggests the training received by Australian medical practitioners  
32 regarding correct medical billing may be highly variable. One possible implication of this variability  
33 is that medical practitioners may be exposed to unnecessary risk of inadvertently falling into non-  
34 compliance with Medicare's requirements, for which possible sanctions can include criminal  
35 liability.<sup>6</sup> This is a finding that mirrors concerns raised in the U.S, where research has shown that  
36 teaching around medical billing to medical practitioners is highly variable and dependent on the  
37 expertise, experience and the confidence of senior mentors, many of whom may themselves have had  
38 little training in the area.<sup>19</sup>

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52 Our study reveals some initiatives by independent organizations to create their own learning modules  
53 on medical billing for medical practitioners in lieu of more formal education. However significant  
54 gaps exist. For example, many vocational education providers described their medical billing courses



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3 as being practical ‘on-the-job’ training programs delivered during placement in GP practices. Yet  
4 such programs did not include specific curriculum content, learning outcomes or formal assessment of  
5 correct Medicare billing. The few courses which were offered by specialist medical colleges consisted  
6 of little more than voluntary attendance at a short presentation, and one stakeholder offered only  
7 optional reading of articles specific to Medicare billing. Whilst these efforts are commendable, the  
8 average course length of less than two hours is unlikely to achieve the high level of legal and  
9 administrative literacy that is expected of medical practitioners working within a complex system of  
10 nearly 6000 reimbursement items, over 900 A4 pages of service descriptions, complex cross-  
11 referencing, administrative permutations and rules. Whilst many medical practitioners may use only a  
12 small subset of these items, some have nevertheless been found guilty of fraud in relation to the  
13 billing of even these small subsets.<sup>6</sup> Others may be unaware of the myriad legal obligations applicable  
14 to each claim, particularly when a single medical service in Australia can be the subject of more than  
15 30 payment rates, multiple rules, and strict penalties for non-compliance.<sup>7</sup>  
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30 Our analyses show most medical billing education initiatives tend to focus on general practice and  
31 educating GPs. Medical specialists - who represent both the majority of Australian registered medical  
32 practitioners<sup>26</sup> and account for the majority of total Medicare expenditure<sup>27</sup> appear to receive almost  
33 no training in this area (with those few specialist organizations who do offer such content to their  
34 members offering it exclusively on a voluntary basis). This finding has particular significance given  
35 most specialists engage in hospital-based medical billing which, in Australia, has profound  
36 complexity.<sup>22,28</sup> It is also noteworthy that our research suggests medical practitioners who are found to  
37 have breached Medicare’s requirements are given no guidance to help improve their medical billing  
38 compliance. One government stakeholder stated that offenders would be referred to Medicare to  
39 further their learning in this area, but it is not clear whether Medicare in fact offers remedial medical  
40 billing training. Lack of formal medical billing education for those who have already been found to  
41 have breached Medicare’s requirements may increase the potential for recidivism. Further, the impact  
42 of incorrect medical billing on consumers in relation to out-of-pocket expenses (OOP) may be  
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3 significant, because correct billing itemisation not only affects government expenditure, but may also  
4 determine whether consumers will be required to pay an OOP and the amount.  
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8 Examining the knowledge and educational needs of medical practitioners around medical billing is  
9 also important because medical practitioners may be investigated for incorrect billing in both civil and  
10 criminal jurisdictions, and relevant determinations in both settings reveal that medical practitioners  
11 under investigation will often state that they did not know the conduct for which they stand accused  
12 was wrong.<sup>6,15,30</sup> Whilst the defence of ignorance has been unsuccessful in preventing conviction  
13 both in Australia and the U.S.,<sup>6,30</sup> the findings of our study suggest there may sometimes be veracity in  
14 such submissions, as the majority of Australian medical practitioners have never been taught how to  
15 bill correctly or at all. Until such time as governments can confidently assert and demonstrate that  
16 medical practitioners are fully cognizant of their medical billing responsibilities, procedural fairness  
17 for medical practitioners under investigation may be denied, and the defence of ignorance will always  
18 remain – at least theoretically – open.  
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32 The majority of medical education stakeholders in our study expressed the view that Australia's  
33 national universal insurer - Medicare - had sole responsibility for developing a standardised course  
34 and teaching correct medical billing to medical practitioners. Currently this is neither supported by the  
35 relevant legislation nor the administrative structure of Medicare.<sup>22,31</sup> The Department of Human  
36 Services (the administrator of Medicare payments in Australia) does have risk management  
37 responsibilities in order to protect the integrity of government payments, and under this component of  
38 its remit Medicare can and has already has adopted successful educational strategies as part of the  
39 departments' broader compliance initiatives.<sup>9,12,23</sup> However, Medicare cannot act as regulator,  
40 educator and prosecutor simultaneously due to inherent conflicts of interests, and in addition, it has  
41 specific legal obligations to conduct its activities within the parameters of the legislative scheme.<sup>31</sup>  
42 These obligations do not give Medicare responsibility for training medical practitioners. Rather, these  
43 are similar arrangements to those that exist with the Australian Taxation Office (ATO) in relation to  
44 tax law, where the ATO may provide support and advice in relation to taxation and also manages risk,  
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3 but actual teaching of tax law and tax accounting is undertaken by external experts, typically inside  
4 academic institutions. A further unique feature of Australia's blended public/private health financing  
5 arrangements provides that Medicare has no jurisdiction over Australia's private health insurance  
6 schemes, (which affect approximately 45% of the population) where many of the most complex  
7 medical billing laws and rules are found.  
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### 14 **Strengths and limitations**

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16 To our knowledge this is the first study which has attempted to systematically map all medical billing  
17 education of Australian medical practitioners. However, there are some limitations that need to be  
18 considered when interpreting our study findings. Multiple data collection methods (telephone, mail  
19 and email) may have elicited some response bias among participants, though this is likely to be  
20 negligible given the exploratory and descriptive nature of this study. Also, since this study, cost  
21 saving initiatives by the federal government in relation to the medical education of GP's has reduced  
22 the number of vocational education providers from the 17 stakeholders included in our study to 11  
23 stakeholders. Further, our study excluded divisions, faculties and chapters which exist under the  
24 umbrellas of the specialist medical colleges who were invited to participate. However, any impact  
25 upon our results is likely to be minimal due to the small numbers of medical practitioners involved  
26 and the focus of such divisions, faculties and chapters on clinical education, policy development and  
27 advocacy, rather than the administrative aspects of medical practice.  
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42 Whilst this study focused on offerings by medical education stakeholders, further research is also  
43 required to explore whether medical practitioners are self-educating or sourcing non-traditional  
44 education on Medicare billing and compliance, thereby achieving the high expected levels of medical  
45 billing literacy expected of them.  
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52 This study reports findings from one country with a mixed public-private health system and a  
53 primarily fee-for-service reimbursement model and may therefore not be completely generalizable to  
54 other settings. Nevertheless, irrespective of whether health care systems are mature or emerging,  
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3 challenges appear to exist at the interface of medical billing and payment system complexity, and  
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5 medical practice across multiple health settings. Increasing private sector involvement in the 65-year-  
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7 old, single public payer, capitation styled NHS of the United Kingdom has exposed compliance  
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9 vulnerabilities,<sup>4,32</sup> and in a starkly different healthcare system with multiple, private payers, and a  
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11 blend of capitation, fee-for-service and salary payment arrangements, the Netherlands has reported  
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13 similar challenges.<sup>10</sup> Commentary on Indonesia's nascent universal healthcare system BPJS (Badan  
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15 Penyelenggara Jaminan Sosial Kesehatan), which uses a mixed capitation and fee-for-service model  
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17 has already described the challenges of medical practitioner compliance under the new scheme,<sup>33</sup> and  
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19 some commentators have suggested that no healthcare system is exempt from billing errors and  
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21 fraud.<sup>4</sup> As such our results may offer insights for regulators, policy-makers and practitioners beyond  
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23 the Australian setting.

## 24 25 26 **Conclusion**

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28 Our study suggests that very little proactive education aimed at improving medical billing compliance  
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30 by medical practitioners is currently occurring or has ever occurred in Australia, and available  
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32 medical billing education may be highly variable and may not deliver the level of expected legal and  
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34 administrative literacy required to effectively and competently use the national insurance scheme and  
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36 ensure program integrity. This is consistent with findings in the U.S where it has been suggested that  
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38 clinicians need to be properly prepared to practice medicine beyond clinical encounters to reduce the  
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40 incidence of potentially serious administrative errors. In the absence of adequate medical billing and  
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42 payment system education for medical practitioners, relevant courts in all countries must give due  
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44 consideration to pleas of ignorance made by medical practitioners facing criminal charges related to  
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46 incorrect medical billing, which may sometimes be legitimate. Rather than reliance on ad-hoc training  
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48 and education, development of a formal national medical billing curriculum for medical practitioners  
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50 should be encouraged to improve billing compliance, expedite judicial processes, enhance program  
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52 integrity and reduce wasted resources in the health system. Further research is required to determine  
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54 the most effective design and delivery of any such curriculum,

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For peer review only

**Table 1:** Characteristics and details of providers of medical billing course (MBC) in Australia

Stakeholder description	Invited	Responded	Offer MBC (% of respondents)	Do not offer MBC
Undergraduate education (University medical schools)	18	17	1 (6%)	16
Postgraduate general practitioner education (Vocational education providers)	17	15	12 (80%)	3
Postgraduate specialist education (Specialist medical colleges)	16	14	2 (14%)	12
Representative professional organizations (State and territory branches of the Australian Medical Association (AMA))	8	5	0 (0%)	5
Medical defence organizations (also known as medical indemnity insurers)	4	4	2 (50%)	2
Government agencies and departments (Australian Health Practitioner Regulation Agency, Professional Services Review Agency and Medicare)	3	2	0 (0%)	2
<b>TOTAL</b>	<b>n = 66</b>	<b>n = 57 (86%)</b>	<b>n = 17 (30%)</b>	<b>n = 40 (70%)</b>

**Table 2:** Details of medical billing courses provided in Australia

Medical billing course (MBC) details	Who is MBC offered to?	When is MBC offered?	Mandatory or voluntary?	How many hours duration?	How long has MBC been offered?	Qualifications of person delivering MBC	How is MBC examined?	Is MBC free or paid?
Undergraduate education (n=1) (University medical schools)	Medical students	In GP rotation (4 <sup>th</sup> year)	Mandatory	<4	5-10 years	Medical qualification	Written exam, assignments/ group projects	Free
Postgraduate general practitioner education (n=12) (Vocational education providers)	GP Registrars	(n=9) Component of induction and introduction program  (n=3) plus ongoing review during training	Mandatory	(n=7) <2 (n=3) 2-4 (n=1) >4  (n=1) varies	(n=8) 5-10 years  (n=4) >10 years	(n=7) Medical Qualification (MQ)  (n=5) MQ plus education qualification	(n=10) not examined  (n=1) informal quiz  (n=1) partially examined	Free
Postgraduate specialist education (n=2) (Specialist medical colleges)	(n=1) Members of our organization  (n=1) Registrars	(n=1) annually in some states and bi-annually in others  (n=1) at annual scientific congress	Voluntary	<2	(n=1) >10 years  (n=1) <1 year	Medical qualification	Not examined	(n=1) Pay  (n=1) Free
Medical defence organizations (n=2) (also known as medical indemnity insurers)	Members of our organization	(n=1) Articles in member publications  (n=1) ad-hoc	Voluntary	(n=1) Free reading  (n=1) <2	(n=1) 5-10 years  (n=1) <5 years	(n=1) Legal qualification  (n=1) Medical qualification	Not examined	Free
TOTAL n=17	n=12 offered to GPs only	n=13 during orientation /induction	n=13 Mandatory	n = 10 <2	n=10 5-10 years	n=16 medical qualifications	n=14 not examined	n=16 Free

**Table 3:** Stakeholder perceptions on who should provide medical billing education\*

Suggested providers of medical billing courses	Those not teaching medical billing (n=40) who felt it <b>should</b> be taught (n=29) suggested the following stakeholders should teach it	Those not teaching medical billing who felt it <b>should not</b> be taught (n=11). 15% of these respondents (n=5) still suggested who should teach it	Total who responded (n=34)
Medicare	24	4	28
Australian Medical Association	6	1	7
Specialist Colleges	5	1	6
Medical Boards	4	0	4
Universities	3	0	3
Medical Defence Organizations	3	0	3
Vocational training providers	2	0	2
Private health funds	1	1	2
Total no. suggestions	48	7	55

\* 34 stakeholders who did not provide their own medical billing courses responded to this question. They comprise 29 positive responses to the question: "Do you think doctors should be taught medical billing?" and 5 negative responses who went on to suggest training providers. Many chose more than one stakeholder when responding.



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10 systems, the MBS has no relationship with the International Classification of Disease (ICD) codes and  
11 therefore there is no nexus at all between the work of Australian clinical coders and those who may  
12 process medical bills for Australian doctors. The MBS also has no relationship with CPT, HCPC,  
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# Claiming and compliance under the Medicare Benefits Schedule (MBS)

For the purposes of this survey:

1. The term 'medical billing course' means:

Any form of training program, education program, lecture, syllabus, classes, seminar, workshop, subject or study program offered by your faculty/college/board/organisation/department\* on the topic of claiming and compliance under the Medicare Benefits Schedule.

\* The different participants will be addressed when surveyed using the following:

Medical schools = faculty

Royal Australian Colleges = college

Medical Boards and Professional Standards Review (PSR) Board = board / panel members

Medical Defense Organisations (MDO) and the Australian Medical Association (AMA) = organisation / employees / members

Medicare = department / employees

**1. Does your faculty/college/board/organisation/department\* offer a medical billing course to its students / medical practitioner trainees/ members / employees in provider liaison, provider interpretation and provider auditing\* / personnel who make decisions on matters of medical practitioner compliance with the Medicare Benefits Schedule\*\*?**

Yes (skip to question 7)

No

**2. Did your faculty/college/board/organisation/department\* ever offer a medical billing course?**

Yes

No (skip to question 5)

**3. When was the medical billing course discontinued?**

0-1 year ago

1-2 years ago

2-5 years ago

more than 5 years ago

## Claiming and compliance under the Medicare Benefits Schedule (MBS)

### 4. Which of the following best describes why the medical billing course was discontinued?

- No longer seen as important
- Insufficient space in the curriculum
- Lack of interest
- No-one to teach it

Other (please specify)

### 5. Do you think that medical practitioners/medical students should be required to attend a medical billing course?

- Yes
- No (end of survey)

### 6. Who do you think should be responsible for delivering a medical billing course? (end of survey)

- Medicare
- The AMA
- The colleges
- The medical defense organisations
- The universities
- The medical boards

Other (please specify)

## Claiming and compliance under the Medicare Benefits Schedule (MBS)

### 7. Which of the following best describes who the medical billing course is offered to?

- Medical students
- Post graduate students
- Alumni
- Members of our organisation
- Employees
- All medical practitioners

Other (please specify)

### 8. Please describe when the medical billing course is offered (eg: in the final year of the degree / in the first week of the induction program / courses are offered throughout the year)

### 9. Is the medical billing course mandatory or voluntary?

- Mandatory
- Voluntary

### 10. How many hours duration is the medical billing course?

- 0-1 hour
- 1-2 hours
- 2-4 hours
- more than 4 hours

Other (please specify)

### 11. How long has your faculty/college/board/organisation/department\* been offering the medical billing course?

- 0-1 year
- 1-5 years
- 5-10 years
- More than 10 years

## Claiming and compliance under the Medicare Benefits Schedule (MBS)

**12. Which of the following best describes the qualifications of the person or people responsible for delivering the medical billing course?**

- Legal qualification
- Education qualification
- Medical qualification
- Ethics qualification
- No formal qualifications

Other (please specify)

**13. How is the medical billing course examined?**

- Multiple choice examination
- Written answer examination
- Take home examination
- Assignments / group projects
- The course is not examined

Other (please specify)

**14. Is the medical billing course offered as a free course or do participants have to pay?**

- It is free
- Have to pay

The following question will be asked to Medicare, the Medical Boards and the PSR

**15. Where are medical practitioners who have been found to have breached their Medicare compliance obligations directed to attend medical billing courses to further their learning?**

- Medicare
- The AMA
- The colleges
- The Medical Defense Organisations
- No suggestions are made about where to access further learning on medical billing

Other (please specify)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

*Who teaches medical billing? A national cross-sectional survey of Australian medical education stakeholders. Faux et al 11 March 2018*

	Item No	Recommendation
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract <b>[Within the title page 1 and design section of the abstract page 3]</b> (b) Provide in the abstract an informative and balanced summary of what was done and what was found <b>[See outcomes and measures, results and conclusion section of abstract page 3]</b>
<b>Introduction</b>		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported <b>[within page 6 and the first paragraph of page 7]</b>
Objectives	3	State specific objectives, including any prespecified hypotheses <b>[within the abstract in the objectives section on page 3, and last paragraph page 8 extending to the first paragraph page 9]</b>
<b>Methods</b>		
Study design	4	Present key elements of study design early in the paper <b>[see second paragraph page 9 in the Methods section]</b>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection <b>[see second paragraph page 9 in the Methods section and page 10 second paragraph in the Results section]</b>
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants <b>[see second paragraph page 9 in the Methods section]</b>
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable <b>[within the content of pages 10 and 11 in the Results section and in the Tables on pages 18, 19 and 20]</b>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group <b>[within Methods section on pages 9 and 10, the first paragraph of the Results section on page 10 and the three Tables on pages 18, 19 and 20]</b>
Bias	9	Describe any efforts to address potential sources of bias <b>[within Strengths and Limitations section on pages 15 and 16]</b>
Study size	10	Explain how the study size was arrived at <b>[see first sentence of second paragraph in the Methods section on page 9]</b>
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why <b>[ N/A ]</b>
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding <b>[see first paragraph page 10]</b> (b) Describe any methods used to examine subgroups and interactions <b>[see first paragraph page 10, and within Tables on pages 18, 19 and 20]</b> (c) Explain how missing data were addressed <b>[ N/A ]</b> (d) If applicable, describe analytical methods taking account of sampling strategy <b>[N/A ]</b> (e) Describe any sensitivity analyses <b>[ N/A ]</b>

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<b>Results</b>		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed [ <b>within Methods section on page 9 and results on page 10</b> ] (b) Give reasons for non-participation at each stage [ <b>N/A</b> ] (c) Consider use of a flow diagram [ <b>N/A</b> ]
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders [ <b>within methods section on page 9 and first paragraph of page 10</b> ] (b) Indicate number of participants with missing data for each variable of interest [ <b>N/A</b> ]
Outcome data	15*	Report numbers of outcome events or summary measures [ <b>within Results section on pages 10 and 11 and the three Tables on pages 18, 19 and 20</b> ]
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included [ <b>within Results section on pages 10 and 11 and the three Tables on pages 18, 19 and 20</b> ] (b) Report category boundaries when continuous variables were categorized [ <b>N/A</b> ] (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period [ <b>N/A</b> ]
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses [ <b>see page 11 second paragraph and Table 3 on page 20</b> ]
<b>Discussion</b>		
Key results	18	Summarise key results with reference to study objectives [ <b>page 11 first two paragraphs in the Discussion section</b> ]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias [ <b>within strengths and limitations section on pages 15 and 16</b> ]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence [ <b>within conclusion on page 17</b> ]
Generalisability	21	Discuss the generalisability (external validity) of the study results [ <b>see 3<sup>rd</sup> paragraph on page 16 and continuing to first sentence on page 17</b> ]
<b>Other information</b>		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based [ <b>funding statement is located at the bottom of page 4 at the end of the abstract</b> ]

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).



# BMJ Open

## Who teaches medical billing? A national cross-sectional survey of Australian medical education stakeholders

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3 **Who teaches medical billing? A national cross-sectional survey of Australian medical**  
4 **education stakeholders.**  
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6  
7 Corresponding author: Margaret Faux  
8 LLB, PhD Candidate, Faculty of Health  
9 University of Technology, Sydney, Australia

10  
11 Contact details: Address: 10 Park St, Clovelly, Sydney, NSW, Australia, 2031  
12 Email: [margaret.a.faux@student.uts.edu.au](mailto:margaret.a.faux@student.uts.edu.au)  
13 Telephone: +61 414 600 073  
14 Fax: nil

15  
16 Second Author: Dr Jonathan Wardle  
17 PhD  
18 Senior Lecturer, Faculty of Health  
19 University of Technology Sydney, Australia  
20 Visiting Professor, School of Medicine, Boston University  
21 Trans-Pacific Fellow, School of Medicine, University of Washington  
22

23 Third Author: Dr Angelica G Thompson-Butel  
24 PhD  
25 Lecturer, Faculty of Health Sciences  
26 Australian Catholic University, Sydney, Australia  
27

28 Fourth Author: Professor Jon Adams  
29 PhD  
30 ARC Professorial Future Fellow  
31 Professor of Public Health  
32 Director, ARCCIM, Faculty of Health  
33 University of Technology, Sydney, Australia  
34

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### **Contributorship Statement**

Ms Margaret Faux - corresponding author. This paper reports the results of one phase of a three phase PhD project by Ms Faux. As such Ms Faux wrote the first draft of the paper in its entirety and has finalised all subsequent drafts incorporating the feedback and suggestions of the other authors. In addition she is responsible for the concept and design of the study, conducted all literature searches and compiled the references, prepared the tables, was involved in the data collection and analysed and interpreted the results.

Dr Jon Wardle - second author Dr Wardle is the principal supervisor for Ms Faux's Doctorate. Dr Wardle has made substantial contributions to this paper at every stage, including having involvement in the proposed concept and design of the study, through to making substantial contributions to the paper via review, critical analysis, feedback and re-drafting sections of the paper to refine important intellectual content.

Dr Angelica Thompson-Butel - third author Dr Thompson-Butel conducted the majority of the data collection and was also involved in data analysis and interpretation. She has made a substantial contribution to the content of the discussion section of the paper as a result of her close association with the data.

Professor Jon Adams - fourth author Professor Adams is the co-supervisor of Ms Faux's Doctorate. Professor Adams has made substantial contributions to later drafts of this paper via review and re-drafting of important intellectual content.

### **Data sharing statement**

We do not see data sharing as relevant to this study, however the deidentified results are available to researchers having an interest in this area. Please contact the corresponding author by email to make enquiries.

## Abstract

**Importance:** Billing errors and healthcare fraud have been described by the World Health Organization as ‘the last great unreduced health-care cost’. Estimates suggest 7% of global health expenditure (\$487 billion USD) is wasted from this phenomenon. Irrespective of different payment models, challenges exist at the interface of medical billing and medical practice across the globe. Medical billing education has been cited as an effective preventative strategy, with targeted education saving \$250 million in Australia in one year from an estimated \$1-3 billion of waste.

**Objective:** This study attempts to systematically map all avenues of medical practitioner education on medical billing in Australia and explores the perceptions of medical education stakeholders on this topic.

**Design:** National cross-sectional survey between April 2014 and June 2015. No patient or public involvement. Data analysis - descriptive statistics via frequency distributions.

**Participants:** All stakeholders who educate medical practitioners regarding clinical practice (n=66). 86% responded.

**Results:** There is little medical billing education occurring in Australia. The majority of stakeholders (70%, n=40) did not offer/have never offered, a medical billing course. 89% thought medical billing should be taught, including 30% (n=17) who were already teaching it. There was no consensus on when medical billing education should occur.

**Conclusions:** To our knowledge, this is the first attempt of any country to map the ways doctors learn the complex legal and administrative infrastructure in which they work. Consistent with U.S findings, Australian doctors may not have expected legal and administrative literacy. Rather than reliance on ad-hoc training, development of an Australian medical billing curriculum should be encouraged to improve compliance, expedite judicial processes and reduce waste. In the absence of adequate education, disciplinary bodies in all countries must consider pleas of ignorance by doctors under investigation, where appropriate, for incorrect medical billing.

## Strengths and limitations of this study

- Despite medical billing errors and fraud being a significant problem, and education having been proven as an effective preventative strategy, to our knowledge this is the first study which has attempted to systematically map medical billing education of Australian medical practitioners.
- Multiple data collection methods (telephone, mail and email) may have elicited some response bias among participants, though this is likely to be negligible
- Since this study, federal government initiatives in relation to the medical education of General Practitioners (GP) has reduced the number of GP post-graduate training providers (referred to in this study as vocational education providers) from the 17 stakeholders included in our study to 11 stakeholders.
- Our study excluded divisions, faculties and chapters which exist under the umbrellas of the specialist medical colleges who were invited to participate, however any impact upon our results is likely to be minimal.
- This study reports findings from one country with a mixed public-private health system and a primarily fee-for-service reimbursement model and may therefore not be completely generalizable to other settings.

### **Funding statement**

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

### **Competing interests statement.**

Margaret Faux is the founder and CEO of a medical billing company, and the holder of a patent for a medical billing app.

Angelica G Thompson-Butel received fees from Margaret Faux for casual work as a research assistant during the data collection phase of this project.

## Introduction

Reimbursement is a component of every encounter between a medical practitioner and a patient. From their first day of internship, medical practitioners have simultaneous and inextricably linked clinical and administrative responsibilities which form the basis upon which the license to practice medicine exists. The funding arrangements in the majority of countries which facilitate reimbursements to medical practitioners, employ some form of classification system which directly or indirectly links payments and resource allocation to patient interactions.<sup>1</sup>

The complexity of health classification systems, such as the international classification of diseases (ICD), while necessary to facilitate funding arrangements, may be a contributing factor to information asymmetries in the health care market. Whilst some initiatives and recommendations have attempted to minimise the specific impact of financial information asymmetry on healthcare costs, it remains a significant problem.<sup>2,3</sup> Most patients do not understand the clinical descriptions of services itemised on their medical bills, are not in a position to question the accuracy of procedural services performed on them while they were under general anaesthesia or unconscious in an intensive care unit, and will typically have no knowledge or understanding of ICD and billing codes which may operate in their jurisdictions. This places medical practitioners in a rare position of privilege when compared to other professionals and service providers with whom consumers may exercise more discernment and question anomalies on their bills. Patients have little option other than to trust medical practitioners will not only render clinically appropriate services and treatments, but also know how to correctly itemize those services on the relevant bills and claims for reimbursement. Ultimately, all decisions regarding the contents of medical bills are made unilaterally by the medical practitioner, in accordance with her determination of clinical need.

In 2014, measurable average losses caused by fraud and incorrect payments in the world's healthcare systems was estimated at 7% of total global health expenditure, or \$487 billion (USD),<sup>4</sup> and the World Health Organization has identified financial leakage as one of the ten leading causes of

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3 healthcare system waste globally.<sup>1</sup> In Australia, some commentators have suggested that incorrect  
4 billing and fraud costs Australia's tax payer funded healthcare system (Medicare) 10-15% of the  
5 scheme's total cost annually (\$2-3 billion AUD).<sup>5</sup> However, the precise amount of deliberate versus  
6 unintentional misuse of the system has proven impossible to quantify in Australia. As such, the impact  
7 of alternative factors for incorrect billing beyond reporting - such as medical practitioners struggling to  
8 navigate the complex requirements of the Medicare system or inefficiencies that exist within the  
9 system itself – remains unknown. However, the lack of clarity around underpinning legislation and  
10 regulation has been identified by many medical practitioners as an important issue, one that often has  
11 significant professional consequences.<sup>6,7</sup>

22 Medical billing education has been recognised as an effective measure to improve compliance, reduce  
23 incorrect claiming and improve program integrity of health systems,<sup>8,9</sup> with countries such as the  
24 Netherlands recently introducing a requirement that universities and medical specialist training  
25 colleges provide education to medical practitioners in relation to medical billing and the costs of  
26 providing care.<sup>10</sup> However, such initiatives remain uncommon, with much of the available literature  
27 on the prevention of healthcare system waste and misuse largely ignoring education as a potentially  
28 preventive strategy. Instead, available literature focuses on sophisticated predictive modelling and  
29 data analytics, post-payment audit activity, recovery action and punitive measures, which may include  
30 disqualification from funding schemes and custodial sentences for providers.<sup>4,6,11,12,13</sup>

42 In both the U.S and Australia, evidence suggests that the medical profession itself takes a harsh view  
43 of colleagues who bill incorrectly.<sup>8,14</sup> One U.S study of 2300 paediatric graduates highlighted an  
44 'acute and pervasive perception' that medical billing training was inadequate<sup>15</sup> and the medical  
45 student participants of another U.S study rated illegal billing as the second most egregious of 30  
46 vignettes of misconduct, with substance abuse being reported as the most serious misconduct (86.8%),  
47 then illegal billing (69.1%), followed by sexual misconduct (50.0%).<sup>16</sup> Australian medical  
48 practitioners have also been highly critical of colleagues who bill incorrectly<sup>14</sup> and the Medical Board  
49 of Australia recognises the importance of medical billing compliance by requiring certain medical

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3 practitioners to sign a legally binding declaration confirming the practitioner has taught key aspects of  
4 the operation of Australia's Medicare system, including funding arrangements, to colleagues, it thus  
5 being a requirement that assumes prior learning of the Medicare system by medical practitioners.<sup>17</sup>  
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8 However, in Australia we currently do not know how, when or where this learning occurs.  
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12 The U.S federal government has adopted a view that publications produced by Medicare  
13 Administrative Contractors, the Centres for Medicare and Medicaid Services, and Explanation of  
14 Benefits Remittance Statements are adequate education for physicians.<sup>18</sup> However, a small body of  
15 international research on the topic (mostly undertaken in the U.S) suggests medical billing literacy  
16 amongst physicians is low.<sup>15,19</sup> This may provide some explanation as to why the financial cost of  
17 healthcare system misuse continues to be a pressing challenge in many countries.<sup>1,4</sup>  
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26 U.S research on the topic of medical practitioner knowledge of correct medical billing is generally  
27 more mature than other jurisdictions, and has resulted in suggestions that medical billing training  
28 should be viewed as a core competency of medical training, and a national medical billing curriculum  
29 should be developed.<sup>19</sup> Australian literature reveals no formal medical billing curriculum and, with the  
30 exception of a relatively small, rudimentary and non-mandatory selection of brief online learning  
31 materials,<sup>20</sup> only one government approved certificate course regarding medical billing exists.<sup>21</sup>  
32 However, this course is not designed for medical practitioners, but for medical receptionists, who are  
33 not legally responsible for the bills they submit on behalf of medical practitioners.<sup>22</sup>  
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44 There is increasing pressure on medical practitioners in relation to billing compliance  
45 internationally.<sup>1,4,10,11</sup> It has also been identified as an issue in Australia,<sup>12,23</sup> where the medical  
46 billing system is divorced from clinical designations (such as the ICD) and a single medical  
47 service can be the subject of over 30 different fees, rules and penalties.<sup>7</sup> There have been  
48 suggestions education may improve billing literacy,<sup>9</sup> yet there has been scant research  
49 attention on training medical practitioners regarding correct medical billing. In response to  
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3 the dearth of research in this area, this study attempts to systematically map all avenues of  
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5 medical practitioner education on Medicare billing and compliance in Australia, and explores  
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7 the perceptions of medical education stakeholders on the teaching of medical billing in Australia to  
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9 inform appropriate policy and regulatory initiatives.  
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## 11 12 13 **Methods**

14  
15 A national cross-sectional survey of all Australian organizational stakeholders (n=66) who play a role  
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17 in the education of medical practitioners from their first day as medical students through to the end of  
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19 their careers, in relation to clinical practice, was undertaken between April 2014 and June 2015. A  
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21 copy of the survey is included as a supplementary file. The survey framed questions around the  
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23 concept of a 'medical billing course', the definition of which was intentionally broad to include any  
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25 content whatsoever on the specific topic of medical billing under Australia's unique classification  
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27 system known as the Medicare Benefits Schedule (MBS). Unlike many other health systems, the  
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29 MBS has no relationship with ICD codes.<sup>24</sup> The questions focused on course availability, as well as  
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31 views on whether the topic should be taught and who should be responsible for delivery, the duration  
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33 of courses offered, the qualifications of relevant teachers, whether courses were voluntary or  
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35 mandatory, free or paid, and methods of assessment with regard to certification. Participants  
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37 responded to a maximum of 15 questions with the final question being reserved for the government  
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39 stakeholder group. This final question asked where medical practitioners who have been found to  
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41 have breached Medicare's requirements are directed to learn how to bill correctly. The survey was  
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43 designed as a telephone survey however the majority of stakeholders requested an emailed copy prior  
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45 to agreeing to participate. Our study excluded divisions, faculties and chapters which exist under the  
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47 umbrellas of the specialist medical colleges who were invited to participate. Some professional  
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49 stakeholders were Australasian in nature (Australasia is a term for Australia, New Zealand and  
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51 occasionally the Pacific Islands) and we excluded those organisations focussed primarily on New  
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53 Zealand. Descriptive statistics via frequency distributions were used to analyse the data. The study  
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3 was approved by the Human Research Ethics Committee of the University of Technology Sydney  
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5 (HREC 2014000060).  
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### 8 Patient and Public involvement

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10 No patients or members of the public were involved in this study.  
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## 14 **Results**

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16 The response rate was 86% (n=57), with 32 respondents (who represented stakeholder organizations)  
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18 choosing to complete the survey manually by mail and email, and 25 were completed by telephone.  
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20 Characteristics of the stakeholders are presented in Table 1, together with the details of providers of  
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22 medical billing courses in Australia.  
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### 26 Medical billing course delivery and content

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28 The majority of stakeholders (70%, n=40) did not offer, and have never offered, a medical billing  
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30 course. Of those stakeholders who did provide courses regarding medical billing for medical  
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32 practitioners (30%, n=17), the majority (71%, n=12) were vocational education providers facilitating  
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34 postgraduate training exclusively to general practitioners (GPs). The majority of stakeholders who  
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36 provided courses did so as a mandatory component of an induction and introduction program (76%,  
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38 n=13). Most course providers reported a course duration of less than two hours (59%, n=10) and  
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40 almost all providers of medical billing courses stated that the course was delivered by a person with  
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42 medical qualifications, some of whom also had educational qualifications (94%, n=16). The majority  
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44 of medical billing course providers did not include assessment as part of their course (82%, n=14) and  
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46 almost all medical billing course providers provided the course free of charge (94%, n=16). These  
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48 results are presented in table 2.  
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52 Two government agencies responded to question 15, which asked where medical practitioners who  
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54 have been found to have breached Medicare's requirements are directed to learn how to bill correctly  
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56 for their services. One stated that no direction is given to medical practitioners who have been found  
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3 to have breached Medicare's requirements, and the other stated that medical practitioners who have  
4 been found to have breached Medicare's requirements would be referred to Medicare to further their  
5 learning in the area.  
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### 10 Perceptions on who should provide medical billing education

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12 Table 3 shows stakeholder perceptions regarding medical billing courses. 89% of stakeholders  
13 thought that medical billing should be taught to medical practitioners, including 30% (n=17) who  
14 were already teaching it. Of the 40 stakeholders who did not offer a medical billing course, nearly  
15 three-quarters thought that someone should provide a medical billing course for medical practitioners  
16 (72%, n=29). Five respondents who stated that they did not think a medical billing course for medical  
17 practitioners was necessary nevertheless went on to suggest who they thought should deliver a  
18 medical billing course. The majority of respondents who did not think that a course was required were  
19 from undergraduate university medical schools and postgraduate specialist medical colleges. Most  
20 respondents who did not offer a medical billing course offered a view as to who should be responsible  
21 for teaching such a course (85%, n=34) and the majority stated Medicare (82% n=28).  
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### 34 **Discussion**

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36 Our study identified broad agreement amongst medical education stakeholders that medical billing  
37 should be taught to medical practitioners at some point in their careers. However, there appears to be  
38 no consensus amongst the stakeholders on when this should occur.  
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44 Although most Australian medical education stakeholders in our study perceived the topic as  
45 important, most do not believe medical billing education falls within the scope of their own  
46 organizational responsibilities with respect to educating medical practitioners. All respondents  
47 suggested other parties should be responsible for delivering medical billing courses to medical  
48 practitioners. However, the stakeholder organizations who were nominated by other stakeholders as  
49 having responsibility for teaching medical billing to medical practitioners did not necessarily agree  
50 that this responsibility should fall with them. For example, the Australian Medical Association and the  
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3 specialist colleges were among those most commonly selected to deliver courses, yet the nominated  
4 organizations themselves did not agree that this fell within their scope.  
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9 Undergraduate university medical schools and postgraduate specialist medical colleges were the  
10 major category of respondents who did not think that a specific course on medical billing was  
11 required. This finding directly contrasts with international views. The opposite view appears to be  
12 held by these two stakeholder groups in The Netherlands for example, where university medical  
13 schools and postgraduate specialist medical colleges have been tasked with providing training on  
14 medical billing and the costs of providing care to medical practitioners in that country.<sup>10</sup> University  
15 stakeholders reported a general consensus that Medicare billing was of no immediate relevance to  
16 undergraduate students, citing crowded curriculums and the need to prioritise clinical content over  
17 content concerning reimbursement after graduates join the workforce. Some specific postgraduate  
18 specialist colleges stated that any Medicare billing education should occur informally on an ad hoc  
19 basis during internship whenever relevant learning opportunities arise. However, we found that some  
20 postgraduate specialist colleges describe 'questionable' medical billing as unethical behaviour in their  
21 professionalism training modules,<sup>25</sup> yet training provided to their members may not include specific  
22 content on how to bill correctly.  
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38 The lack of qualified educators in this area is also potentially problematic. Our survey reveals that  
39 where medical billing education does exist in Australia, it is provided largely by medical practitioners,  
40 rather than educators with qualifications or expertise in the administrative and legal aspects of  
41 Medicare. As such, our research suggests the training received by Australian medical practitioners  
42 regarding correct medical billing may be highly variable. One possible implication of this variability  
43 is that medical practitioners may be exposed to unnecessary risk of inadvertently falling into non-  
44 compliance with Medicare's requirements, for which possible sanctions can include criminal  
45 liability.<sup>6</sup> This is a finding that mirrors concerns raised in the U.S, where research has shown that  
46 teaching around medical billing to medical practitioners is highly variable and dependent on the  
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3 expertise, experience and the confidence of senior mentors, many of whom may themselves have had  
4 little training in the area.<sup>19</sup>  
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9 Our study reveals some initiatives by independent organizations to create their own learning modules  
10 on medical billing for medical practitioners in lieu of more formal education. However significant  
11 gaps exist. For example, many vocational education providers described their medical billing courses  
12 as being practical ‘on-the-job’ training programs delivered during placement in GP practices. Yet  
13 such programs did not include specific curriculum content, learning outcomes or formal assessment of  
14 correct Medicare billing. The few courses which were offered by specialist medical colleges consisted  
15 of little more than voluntary attendance at a short presentation, and one stakeholder offered only  
16 optional reading of articles specific to Medicare billing. Whilst these efforts are commendable, the  
17 average course length of less than two hours is unlikely to achieve the high level of legal and  
18 administrative literacy that is expected of medical practitioners working within a complex system of  
19 nearly 6000 reimbursement items, over 900 A4 pages of service descriptions, complex cross-  
20 referencing, administrative permutations and rules. Whilst many medical practitioners may use only a  
21 small subset of these items, some have nevertheless been found guilty of fraud in relation to the  
22 billing of even these small subsets.<sup>6</sup> Others may be unaware of the myriad legal obligations applicable  
23 to each claim, particularly when a single medical service in Australia can be the subject of more than  
24 30 payment rates, multiple rules, and strict penalties for non-compliance.<sup>7</sup>  
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42 Our analyses show most medical billing education initiatives tend to focus on general practice and  
43 educating GPs. Medical specialists - who represent both the majority of Australian registered medical  
44 practitioners<sup>26</sup> and account for the majority of total Medicare expenditure<sup>27</sup> appear to receive almost  
45 no training in this area (with those few specialist organizations who do offer such content to their  
46 members offering it exclusively on a voluntary basis). This finding has particular significance given  
47 most specialists engage in hospital-based medical billing which, in Australia, has profound  
48 complexity.<sup>22,28</sup> It is also noteworthy that our research suggests medical practitioners who are found to  
49 have breached Medicare’s requirements are given no guidance to help improve their medical billing  
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3 compliance. One government stakeholder stated that offenders would be referred to Medicare to  
4 further their learning in this area, but it is not clear whether Medicare in fact offers remedial medical  
5 billing training. Lack of formal medical billing education for those who have already been found to  
6 have breached Medicare's requirements may increase the potential for recidivism. Further, the impact  
7 of incorrect medical billing on consumers in relation to out-of-pocket expenses (OOP) may be  
8 significant, because correct billing itemisation not only affects government expenditure, but may also  
9 determine whether consumers will be required to pay an OOP and the amount.  
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18 Examining the knowledge and educational needs of medical practitioners around medical billing is  
19 also important because medical practitioners may be investigated for incorrect billing in both civil and  
20 criminal jurisdictions, and relevant determinations in both settings reveal that medical practitioners  
21 under investigation will often state that they did not know the conduct for which they stand accused  
22 was wrong.<sup>6,14,29</sup> Whilst the defence of ignorance has been unsuccessful in preventing conviction both  
23 in Australia and the U.S,<sup>6,29</sup> the findings of our study suggest there may sometimes be veracity in such  
24 submissions, as the majority of Australian medical practitioners have never been taught how to bill  
25 correctly or at all. Until such time as governments can confidently assert and demonstrate that medical  
26 practitioners are fully cognizant of their medical billing responsibilities, procedural fairness for  
27 medical practitioners under investigation may be denied, and the defence of ignorance will always  
28 remain – at least theoretically – open.  
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42 The majority of medical education stakeholders in our study expressed the view that Australia's  
43 national universal insurer - Medicare - had sole responsibility for developing a standardised course  
44 and teaching correct medical billing to medical practitioners. Currently this is neither supported by the  
45 relevant legislation nor the administrative structure of Medicare.<sup>22,30</sup> The Department of Human  
46 Services (the administrator of Medicare payments in Australia) does have risk management  
47 responsibilities in order to protect the integrity of government payments, and under this component of  
48 its remit Medicare can and has already has adopted successful educational strategies as part of the  
49 departments' broader compliance initiatives.<sup>9,12,23</sup> However, Medicare cannot act as regulator,  
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educator and prosecutor simultaneously due to inherent conflicts of interests, and in addition, it has specific legal obligations to conduct its activities within the parameters of the legislative scheme.<sup>30</sup> These obligations do not give Medicare responsibility for training medical practitioners. Rather, these are similar arrangements to those that exist with the Australian Taxation Office (ATO) in relation to tax law, where the ATO may provide support and advice in relation to taxation and also manages risk, but actual teaching of tax law and tax accounting is undertaken by external experts, typically inside academic institutions. A further unique feature of Australia's blended public/private health financing arrangements provides that Medicare has limited jurisdiction over Australia's private health insurance schemes<sup>31</sup> where many of the most complex medical billing arrangements are found. These schemes incorporate the entire regulatory framework of the MBS,<sup>32</sup> affect approximately 45% of the Australian population,<sup>33</sup> and represent the main form of medical billing for the majority of Australian medical specialists.<sup>34</sup>

### **Strengths and limitations**

To our knowledge this is the first study which has attempted to systematically map all medical billing education of Australian medical practitioners. However, there are some limitations that need to be considered when interpreting our study findings. Multiple data collection methods (telephone, mail and email) may have elicited some response bias among participants, though this is likely to be negligible given the exploratory and descriptive nature of this study. Also, since this study, cost saving initiatives by the federal government in relation to the medical education of GP's has reduced the number of vocational education providers from the 17 stakeholders included in our study to 11 stakeholders. Further, our study excluded divisions, faculties and chapters which exist under the umbrellas of the specialist medical colleges who were invited to participate. However, any impact upon our results is likely to be minimal due to the small numbers of medical practitioners involved and the focus of such divisions, faculties and chapters on clinical education, policy development and advocacy, rather than the administrative aspects of medical practice.

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3 Whilst this study focused on offerings by medical education stakeholders, further research is also  
4 required to explore whether medical practitioners are self-educating or sourcing non-traditional  
5 education on Medicare billing and compliance, thereby achieving the high expected levels of medical  
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7 billing literacy expected of them.  
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12 This study reports findings from one country with a mixed public-private health system and a  
13 primarily fee-for-service reimbursement model and may therefore not be completely generalizable to  
14 other settings. Nevertheless, irrespective of whether health care systems are mature or emerging,  
15 challenges appear to exist at the interface of medical billing and payment system complexity, and  
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17 medical practice across multiple health settings. Increasing private sector involvement in the 65-year-  
18 old, single public payer, capitation styled NHS of the United Kingdom has exposed compliance  
19 vulnerabilities,<sup>4,35</sup> and in a starkly different healthcare system with multiple, private payers, and a  
20 blend of capitation, fee-for-service and salary payment arrangements, the Netherlands has reported  
21 similar challenges.<sup>10</sup> Commentary on Indonesia's nascent universal healthcare system BPJS (Badan  
22 Penyelenggara Jaminan Sosial Kesehatan), which uses a mixed capitation and fee-for-service model  
23 has already described the challenges of medical practitioner compliance under the new scheme,<sup>36</sup> and  
24 some commentators have suggested that no healthcare system is exempt from billing errors and  
25 fraud.<sup>4</sup> As such our results may offer insights for regulators, policy-makers and practitioners beyond  
26 the Australian setting.  
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## 42 **Conclusion**

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44 Our study suggests that very little proactive education aimed at improving medical billing compliance  
45 by medical practitioners is currently occurring or has ever occurred in Australia, and available  
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47 medical billing education may be highly variable and may not deliver the level of expected legal and  
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49 administrative literacy required to effectively and competently use the national insurance scheme and  
50 ensure program integrity. This is consistent with findings in the U.S where it has been suggested that  
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52 clinicians need to be properly prepared to practice medicine beyond clinical encounters to reduce the  
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54 incidence of potentially serious administrative errors. In the absence of adequate medical billing and  
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3 payment system education for medical practitioners, relevant courts in all countries must give due  
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5 consideration to pleas of ignorance made by medical practitioners facing criminal charges related to  
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7 incorrect medical billing, which may sometimes be legitimate. Rather than reliance on ad-hoc training  
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9 and education, development of a formal national medical billing curriculum for medical practitioners  
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11 should be encouraged to improve billing compliance, expedite judicial processes, enhance program  
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13 integrity and reduce wasted resources in the health system. Further research is required to determine  
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15 the most effective design and delivery of any such curriculum,  
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**Table 1:** Characteristics and details of providers of medical billing course (MBC) in Australia

Stakeholder description	Invited	Responded	Offer MBC (% of respondents)	Do not offer MBC
Undergraduate education (University medical schools)	18	17	1 (6%)	16
Postgraduate general practitioner education (Vocational education providers)	17	15	12 (80%)	3
Postgraduate specialist education (Specialist medical colleges)	16	14	2 (14%)	12
Representative professional organizations (State and territory branches of the Australian Medical Association (AMA))	8	5	0 (0%)	5
Medical defence organizations (also known as medical indemnity insurers)	4	4	2 (50%)	2
Government agencies and departments (Australian Health Practitioner Regulation Agency, Professional Services Review Agency and Medicare)	3	2	0 (0%)	2
<b>TOTAL</b>	<b>n = 66</b>	<b>n = 57 (86%)</b>	<b>n = 17 (30%)</b>	<b>n = 40 (70%)</b>

**Table 2:** Details of medical billing courses provided in Australia

Medical billing course (MBC) details	Who is MBC offered to?	When is MBC offered?	Mandatory or voluntary?	How many hours duration?	How long has MBC been offered?	Qualifications of person delivering MBC	How is MBC examined?	Is MBC free or paid?
Undergraduate education (n=1) (University medical schools)	Medical students	In GP rotation (4 <sup>th</sup> year)	Mandatory	<4	5-10 years	Medical qualification	Written exam, assignments/ group projects	Free
Postgraduate general practitioner education (n=12) (Vocational education providers)	GP Registrars	(n=9) Component of induction and introduction program  (n=3) plus ongoing review during training	Mandatory	(n=7) <2 (n=3) 2-4 (n=1) >4  (n=1) varies	(n=8) 5-10 years  (n=4) >10 years	(n=7) Medical Qualification (MQ)  (n=5) MQ plus education qualification	(n=10) not examined  (n=1) informal quiz  (n=1) partially examined	Free
Postgraduate specialist education (n=2) (Specialist medical colleges)	(n=1) Members of our organization  (n=1) Registrars	(n=1) annually in some states and bi-annually in others  (n=1) at annual scientific congress	Voluntary	<2	(n=1) >10 years  (n=1) <1 year	Medical qualification	Not examined	(n=1) Pay  (n=1) Free
Medical defence organizations (n=2) (also known as medical indemnity insurers)	Members of our organization	(n=1) Articles in member publications  (n=1) ad-hoc	Voluntary	(n=1) Free reading  (n=1) <2	(n=1) 5-10 years  (n=1) <5 years	(n=1) Legal qualification  (n=1) Medical qualification	Not examined	Free
TOTAL n=17	n=12 offered to GPs only	n=13 during orientation /induction	n=13 Mandatory	n = 10 <2	n=10 5-10 years	n=16 medical qualifications	n=14 not examined	n=16 Free

**Table 3:** Stakeholder perceptions on who should provide medical billing education\*

Suggested providers of medical billing courses	Those not teaching medical billing (n=40) who felt it <b>should</b> be taught (n=29) suggested the following stakeholders should teach it	Those not teaching medical billing who felt it <b>should not</b> be taught (n=11). 15% of these respondents (n=5) still suggested who should teach it	Total who responded (n=34)
Medicare	24	4	28
Australian Medical Association	6	1	7
Specialist Colleges	5	1	6
Medical Boards	4	0	4
Universities	3	0	3
Medical Defence Organizations	3	0	3
Vocational training providers	2	0	2
Private health funds	1	1	2
Total no. suggestions	48	7	55

\* 34 stakeholders who did not provide their own medical billing courses responded to this question. They comprise 29 positive responses to the question: "Do you think doctors should be taught medical billing?" and 5 negative responses who went on to suggest training providers. Many chose more than one stakeholder when responding.

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10 systems, the MBS has no relationship with the International Classification of Disease (ICD) codes and  
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12 process medical bills for Australian doctors. The MBS also has no relationship with CPT, HCPC,  
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# Claiming and compliance under the Medicare Benefits Schedule (MBS)

For the purposes of this survey:

1. The term 'medical billing course' means:

Any form of training program, education program, lecture, syllabus, classes, seminar, workshop, subject or study program offered by your faculty/college/board/organisation/department\* on the topic of claiming and compliance under the Medicare Benefits Schedule.

\* The different participants will be addressed when surveyed using the following:

Medical schools = faculty

Royal Australian Colleges = college

Medical Boards and Professional Standards Review (PSR) Board = board / panel members

Medical Defense Organisations (MDO) and the Australian Medical Association (AMA) = organisation / employees / members

Medicare = department / employees

**1. Does your faculty/college/board/organisation/department\* offer a medical billing course to its students / medical practitioner trainees/ members / employees in provider liaison, provider interpretation and provider auditing\* / personnel who make decisions on matters of medical practitioner compliance with the Medicare Benefits Schedule\*\*?**

Yes (skip to question 7)

No

**2. Did your faculty/college/board/organisation/department\* ever offer a medical billing course?**

Yes

No (skip to question 5)

**3. When was the medical billing course discontinued?**

0-1 year ago

1-2 years ago

2-5 years ago

more than 5 years ago

## Claiming and compliance under the Medicare Benefits Schedule (MBS)

### 4. Which of the following best describes why the medical billing course was discontinued?

- No longer seen as important
- Insufficient space in the curriculum
- Lack of interest
- No-one to teach it

Other (please specify)

### 5. Do you think that medical practitioners/medical students should be required to attend a medical billing course?

- Yes
- No (end of survey)

### 6. Who do you think should be responsible for delivering a medical billing course? (end of survey)

- Medicare
- The AMA
- The colleges
- The medical defense organisations
- The universities
- The medical boards

Other (please specify)



## Claiming and compliance under the Medicare Benefits Schedule (MBS)

### 7. Which of the following best describes who the medical billing course is offered to?

- Medical students
- Post graduate students
- Alumni
- Members of our organisation
- Employees
- All medical practitioners

Other (please specify)

### 8. Please describe when the medical billing course is offered (eg: in the final year of the degree / in the first week of the induction program / courses are offered throughout the year)

### 9. Is the medical billing course mandatory or voluntary?

- Mandatory
- Voluntary

### 10. How many hours duration is the medical billing course?

- 0-1 hour
- 1-2 hours
- 2-4 hours
- more than 4 hours

Other (please specify)

### 11. How long has your faculty/college/board/organisation/department\* been offering the medical billing course?

- 0-1 year
- 1-5 years
- 5-10 years
- More than 10 years

## Claiming and compliance under the Medicare Benefits Schedule (MBS)

**12. Which of the following best describes the qualifications of the person or people responsible for delivering the medical billing course?**

- Legal qualification
- Education qualification
- Medical qualification
- Ethics qualification
- No formal qualifications

Other (please specify)

**13. How is the medical billing course examined?**

- Multiple choice examination
- Written answer examination
- Take home examination
- Assignments / group projects
- The course is not examined

Other (please specify)

**14. Is the medical billing course offered as a free course or do participants have to pay?**

- It is free
- Have to pay

The following question will be asked to Medicare, the Medical Boards and the PSR

**15. Where are medical practitioners who have been found to have breached their Medicare compliance obligations directed to attend medical billing courses to further their learning?**

- Medicare
- The AMA
- The colleges
- The Medical Defense Organisations
- No suggestions are made about where to access further learning on medical billing

Other (please specify)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

*Who teaches medical billing? A national cross-sectional survey of Australian medical education stakeholders. Faux et al 11 March 2018*

	Item No	Recommendation
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract <b>[Within the title page 1 and design section of the abstract page 3]</b> (b) Provide in the abstract an informative and balanced summary of what was done and what was found <b>[See outcomes and measures, results and conclusion section of abstract page 3]</b>
<b>Introduction</b>		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported <b>[within page 6 and the first paragraph of page 7]</b>
Objectives	3	State specific objectives, including any prespecified hypotheses <b>[within the abstract in the objectives section on page 3, and last paragraph page 8 extending to the first paragraph page 9]</b>
<b>Methods</b>		
Study design	4	Present key elements of study design early in the paper <b>[see second paragraph page 9 in the Methods section]</b>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection <b>[see second paragraph page 9 in the Methods section and page 10 second paragraph in the Results section]</b>
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants <b>[see second paragraph page 9 in the Methods section]</b>
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable <b>[within the content of pages 10 and 11 in the Results section and in the Tables on pages 18, 19 and 20]</b>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group <b>[within Methods section on pages 9 and 10, the first paragraph of the Results section on page 10 and the three Tables on pages 18, 19 and 20]</b>
Bias	9	Describe any efforts to address potential sources of bias <b>[within Strengths and Limitations section on pages 15 and 16]</b>
Study size	10	Explain how the study size was arrived at <b>[see first sentence of second paragraph in the Methods section on page 9]</b>
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why <b>[ N/A ]</b>
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding <b>[see first paragraph page 10]</b> (b) Describe any methods used to examine subgroups and interactions <b>[see first paragraph page 10, and within Tables on pages 18, 19 and 20]</b> (c) Explain how missing data were addressed <b>[ N/A ]</b> (d) If applicable, describe analytical methods taking account of sampling strategy <b>[N/A ]</b> (e) Describe any sensitivity analyses <b>[ N/A ]</b>

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<b>Results</b>		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed [ <b>within Methods section on page 9 and results on page 10</b> ] (b) Give reasons for non-participation at each stage [ <b>N/A</b> ] (c) Consider use of a flow diagram [ <b>N/A</b> ]
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders [ <b>within methods section on page 9 and first paragraph of page 10</b> ] (b) Indicate number of participants with missing data for each variable of interest [ <b>N/A</b> ]
Outcome data	15*	Report numbers of outcome events or summary measures [ <b>within Results section on pages 10 and 11 and the three Tables on pages 18, 19 and 20</b> ]
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included [ <b>within Results section on pages 10 and 11 and the three Tables on pages 18, 19 and 20</b> ] (b) Report category boundaries when continuous variables were categorized [ <b>N/A</b> ] (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period [ <b>N/A</b> ]
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses [ <b>see page 11 second paragraph and Table 3 on page 20</b> ]
<b>Discussion</b>		
Key results	18	Summarise key results with reference to study objectives [ <b>page 11 first two paragraphs in the Discussion section</b> ]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias [ <b>within strengths and limitations section on pages 15 and 16</b> ]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence [ <b>within conclusion on page 17</b> ]
Generalisability	21	Discuss the generalisability (external validity) of the study results [ <b>see 3<sup>rd</sup> paragraph on page 16 and continuing to first sentence on page 17</b> ]
<b>Other information</b>		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based [ <b>funding statement is located at the bottom of page 4 at the end of the abstract</b> ]

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).