

Department of Health and Human Services

PLANNING PURCHASING AND PERFORMANCE



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Consultation Paper on the Pricing Framework for Australian Public Hospital Services 2017-18

Thank you for your email correspondence of 30 September 2016, addressed to Mr Michael Pervan, Secretary, DHHS, seeking comment to inform the development of the Pricing Framework for Public Hospital Services 2017-18. The Secretary has requested that I respond to you on his behalf.

Please find attached the Tasmanian Department of Health and Human Services submission in response to the '*Consultation Paper on the Pricing Framework for Australian Public Hospital Services 2017-18*', together with electronic copies of additional supporting materials.

Thank you for the opportunity to provide comment.

Yours sincerely

A handwritten signature in black ink, appearing to read "MHensher", with a long horizontal line extending to the right.

Martin Hensher
Acting Deputy Secretary, Planning Purchasing and Performance

28 October 2016

Attachment 1. Tasmanian DHHS Submission

Attachment 2. Comments regarding list of Hospital Acquired Complications included in the Consultation Paper incl supporting material

Prepared by	Valerie Whelan	Manager ABF Implementation Program	61661046	28 October 2016
Through	Peter Russell	Assistant Director, Clinical Costing and Resource Strategy	61661083	28 October 2016
Cleared by	Martin Hensher	Acting Deputy Secretary, Planning Purchasing and Performance	61661074	28 October 2016

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Attachment I.

Responses to the Consultation Questions - IHPA Consultation Paper on the Pricing Framework for Public Hospital Services 2017-18

Classifications used by IHPA to describe Public Hospital Services

Section 4.4 Australian National Subacute and Non Acute Patient Classification

Consultation question

- What additional areas should IHPA consider in developing Version 5 of the Australian National Subacute and Non-Acute Patient classification?

Tasmania's sub-acute data collection systems are not mature. Work is currently in progress to implement the AN-SNAP Version 4 classification system within the Tasmanian Health Service. It is recommended that Version 5 should include additional definitional work pertaining to the split between ambulatory Same Days admitted activity and non-admitted (outpatient) activity, particularly in the area of Rehabilitation.

The National Efficient Price for Activity Based Funded Public Hospital Services

Section 6.1 Technical Improvements

Consultation question

- Should IHPA consider any further technical improvements to the pricing model used to determine the National Efficient Price for 2017-18?

Tasmania has consistently argued in numerous previous submissions, to the IHPA, that in Tasmania's case the cost of providing health services is affected primarily by three factors which generally have compounding effects in their interaction:

- Small scale due to small population
- The most decentralised population pattern in the nation (with Hobart being the only capital city with below 50 per cent of a state or territory population); and
- Regionality, in terms of both intrastate characteristics (as indicated by the decentralised population spread) and interstate characteristics, due to its small population size and isolation from the mainland.

In Tasmania, the public sector is the only provider of a range of highly specialised services including, cardio-thoracic surgery, neo-natal intensive care, neurosurgery and burns. The sustainability of these services is challenging in a small population where there are no economies of scale.

As a consequence of being a small population, Tasmania is also a significant exporter of highly complex health care services interstate, for service such as organ transplant, Cochlear implant, complex cancer, and complex paediatric services, due to volume and skill limitations within the state. Tasmania is subject to

increased costs as an exporter of health care services, particularly in the areas of transport and accommodation.

Whilst Tasmania is not seeking to argue that the National Efficient Price (NEP) needs to be cognisant of each state's individual characteristics, Tasmania believes that it must recognise 'like circumstances' across the country, similar to the approach taken by the Commonwealth Grants Commission.

Tasmania is aware that a Patient Remoteness Area Adjustment is under consideration for NEP17 to reflect the very high costs incurred by some regional and remote patients in relation to emergency medical inter-hospital transfers to interstate hospitals, and supports this approach.

Tasmania will, in the near future, undertake a detailed analysis to support the development of an application for consideration by IHPA, within the scope of the IHPA "Assessment of Legitimate and Unavoidable Cost Variations Framework", in relation to the issues raised above.

Section 6.3 Stability of the National Pricing Model

Consultation questions

- Should IHPA further restrict year-on-year changes in price weights?
- What are the priority areas for IHPA to consider when evaluating adjustments to NEP17?
- What patient-based factors would provide the basis for these or other adjustments? Please provide supporting evidence, where available.

Tasmania agrees with the current IHPA stabilisation approach.

Setting the National Efficient Price for Private Patients in Public Hospitals

Section 7.3 Pricing Private Patients

Consultation question

- Should IHPA phase out the private patient correction factor in 2018-19 if it is feasible to do so?

Tasmania believes that IHPA should be working towards the phasing out of the Private Patient Correction Factor dependent upon all jurisdictions moving towards compliance with the Australian Hospital Patient Costing Standards.

Bundled Pricing for Maternity Care

Section 9.4 Next Steps

Consultation questions

- Do you support IHPA's intention to introduce a bundled price for maternity care in future years?
- What stages of maternity care and patient groups should be included in the bundled price?
- Should IHPA include postnatal care provided to the newborn in the bundled price?
- What other issues should IHPA consider in developing the bundled price?

Tasmania supports the bundling of both antenatal and postnatal care for maternity services. However, it will be necessary for IHPA to develop a methodology of differentiating the various modes of delivery of maternity products provided across both the public and private sectors.

Pricing and Funding for Safety and Quality

Section 11.1 The Rationale for Pricing and Funding for Safety and Quality

Tasmania has concerns that there is a risk of duplication in IHPA identifying its role as “*collecting and analysing safety and quality data to improve care*”. There needs to be clear delineation of responsibilities between IHPA and the Australian Commission on Safety and Quality in Health Care (the Commission).

Furthermore, Tasmania believes it is inappropriate for IHPA to suggest that “*Incorporating safety and quality into pricing and funding models signals to clinicians and hospital managers that governments value high quality and safe health care*”.

Firstly, it should be acknowledged that clinicians and hospital managers are already committed to high quality safe care; and the government commitment is also strong. Secondly, the concept of pricing penalties may be counter-productive to the delivery of high quality and safe health care, if it ultimately results in hospitals having insufficient resources.

While Tasmania fully supports the development of the Australian Safety and Quality Framework for Health Care, by the Commission on Safety and Quality in Healthcare (the Commission), the Commission should also promote a culture of continuous improvement and one where staff feel empowered to report and review episodes of care that are not safe or high quality.

Tasmania believes that Pricing Framework must ensure that the emphasis on pricing for safety and quality is primarily focussed on safety and quality improvements; and not purely as a means to bluntly penalise states and territories through decreased pricing and funding. It is important that any pricing or funding model needs to consider that the removal of funding may make it difficult for a health service to correct system errors if the financial penalty has a major impact.

Shadowing the Implementation of Pricing for Safety and Quality

There has been no discussion in the consultation paper on the means by which a ‘shadow’ year will be implemented ahead of the establishment of the new pricing model for safety and quality.

The intention of the shadow period is to enable jurisdictions and health system participants to test the proposed system for pricing for safety and quality and minimise any financial or operational risk prior to formal implementation. The length of the shadow period is identified as a minimum of 12 months, but may need to be longer depending on the complexity of the proposed system, the timing of data flows and how long it takes to demonstrate that the model can be implemented without adverse consequences. Appropriate evaluation of the shadow period and any necessary adjustments should occur prior to full implementation.

Tasmania would require the IHPA to provide it with granular data identifying the pricing and funding impacts of the proposed pricing model. This will include sufficient activity and pricing data to individual hospital level to enable the State to identify and understand safety and quality issues and model funding impacts on individual hospitals. The data should be sufficient to enable the Local Hospital Network (Tasmanian Health Service) to provide feedback to individual clinicians.

Safety and quality activity and pricing data at jurisdiction level for other States and Territories would also be useful for comparison and benchmarking purposes. Tasmania does not agree with the reporting of this data to be made public during the shadow year. The progress of the ‘shadow’ year should be discussed as a standing agenda item regularly during the year at the IHPA Technical Advisory Committee meetings.

Section 11.4.1 Scope

Consultation question

- Is there support for pricing and funding models for safety and quality to be applied broadly across all types of public hospitals, all services, all patients and all care settings?

Tasmania agrees in principle with a broad application across all patients and all care settings. From a safety and quality perspective, it is important to know where events are happening, why they are happening and what caused them to happen. However, it is unclear how well a risk adjustment could be applied across all settings.

It may be appropriate for IHPA to consider at this point that the scope only consider ABF funded activity, with a focus on inpatients, with other settings, including block funded activity to be considered at a later stage as systems mature.

Section 11.4.4 Risk Adjustment

Consultation question

- What factors should be considered in risk adjustment for safety and quality in pricing and funding models for hospital care?

Risk adjustment factors should take into account an ageing population and associated multi-morbidity; both of which are key factors in the Tasmanian population. This patient cohort, with inherently increased complexity, is potentially at greater risk of more Hospital Acquired Conditions (HACs).

The HAC list includes Cardiac Complications and Heart Failure. The detection of Heart Failure in relation to an inpatient's episode of care must be set against the background prevalence of that condition in the community. In Tasmania, there is an overrepresentation of heart failure in comparison with the Australian average; this represents an increased burden of risk to the state when compared to Australia wide admissions. Refer Attachment 2. Chan et al (2016) '*Current and projected burden of heart failure in the Australian adult population: a substantive but still ill-defined major health issue*', BMC Health Services Research 16:501).

It is important that any risk adjustment take into account the type of care. In relation to HACs, this would require careful assessment due to the fact that a patient having one of the HACs may very well lead to that same patient having a second HAC. The risk is not going to be the same if the patient has other complicating factors. For example being unwell in ICU on a ventilator predisposes a patient to having Venous Thromboembolism (VTE), and coming off sedation when the ventilator is removed is a trigger for delirium. These scenarios are different when compared to a patient on a general ward who may develop a VTE or delirium without having any of the risk factors of being on a ventilator.

The risk adjustment weighting needs to be sensitive to the fact that for some HACs, having one already makes having another one more likely. This is different from determining equitable risk which looks at the patient variables that put certain patients at higher risk, rather than the compounded risk associated with having a HAC in the first place.

Differentiating between incentives to mitigate risk and providing fair funding for hospitals that treat higher number of higher risk patients should take into account the base payment. Base payments should be set

higher for those patients at greatest risk of an adverse event, than the base rate for those patients with a low risk of an adverse event, with no specific adjustment occurring for a specific adverse event.

Section 11.4.5 Criteria for assessing pricing and funding options

Consultation question

- Do you agree with the use of these assessment criteria to evaluate the relative merit of different approaches to pricing and funding for safety and quality? Are there other criteria that should be considered?

Proportionality should include the concept of avoiding any double penalty - hospitals should not bear the excess cost of dealing with sentinel events, HACs or re-admissions twice. Where the effective payment is based on episodic treatment that effectively excludes the additional cost of a HAC or other adverse outcome, then there should be no additional penalty.

Tasmania generally agrees with the use of the proposed assessment criteria but risk adjustments should be considered particularly in the case of HACs. For example, having two HACs is not 1 + 1 but possibly 1.5 HACs because the first HAC predisposes or increases the likelihood of the second one occurring.

Sentinel Events

Section 11.5.2 Incidence and Reporting of Sentinel Events

The agreed set of eight sentinel events has been reported nationally since 2004-05, initially by the Australian Institute of Health and Welfare (AIHW) and the Commission, then through the Commission's *Windows into Safety and Quality in Health Care* annual reports.

It should be noted that for Tasmania, these data are based upon incidents that were self-reported into the jurisdictions' incident management system. It is not currently based on data captured in the Hospital Patient Administration System (PAS) dataset. Some of the eight events cannot be recorded by the PAS because the hospitals do not currently capture the information in that system.

Broadly, any system adopted must avoid perverse incentives – a combination of funding penalty and self-reporting has the potential to incentivise under-reporting of sentinel events. This would be counterproductive and inconsistent with improving transparency in safety and quality measures. The integrity of a system that relies on self-reporting is inherently questionable.

Section 11.5.3 Policy Context of Pricing and Funding Models to reduce Sentinel Events

Following the 2016 Heads of Agreement, IHPA has been directed to provide advice on: “A comprehensive and risk-adjusted model to determine how funding and pricing can be used to improve patient outcomes and reduce the amount the Commonwealth pays for sentinel events that occur in public hospitals”.

Tasmania believes that the directive requires further clarification because sentinel events and never events are different concepts. It is understood that the Commission is currently working on the list so that only those events that are wholly avoidable, and have a system in place that should have prevented the event from happening, will not be funded.

Section 11.5.4 Approaches to pricing and funding of Sentinel Events

Consultation question

- Do you support the proposal to not fund episodes that include a sentinel event? If not, what are the alternatives and how could they be applied consistently?

The approach to pricing and funding of sentinel events is driven by their very low prevalence. Tasmania believes this is one of the reasons why pricing and funding will not really change the practice, however it will send a signal to the public that the Commonwealth is concerned about safety and quality in health care and will not pay for things that go wrong.

An alternative funding approach would be to ensure that no additional payments are received on the basis of a sentinel event, meaning that any additional cost is borne by the provider hospital. Timing issues may be another factor impacting on the consistent application of approaches to the pricing and funding of sentinel events, due to delays in reporting of sentinel events and awareness that a sentinel event has occurred.

On the basis of the model proposed, if the NWAU for sentinel events is to be set at zero, it is assumed that previous activity and funding will be back-cast and the Commonwealth contribution recalculated. If this is the case, while there would no longer be a marginal Commonwealth payment for sentinel events, there would not be a significant funding deficit effect.

It is noted that IHPA is not proposing to risk adjust for sentinel events as there is no justification for risk adjustment linked to any patient based factors such as age and complexity of care. Tasmania also understands that the Commission is currently working towards revised definitions for sentinel events, by July 2017, which would support this proposal.

Tasmania supports the proposal not to fund episodes that include a sentinel event on the basis that the events on the list are wholly avoidable, that there are systems in place that mean these events should not happen; and that we are provided the opportunity to compare our administrative dataset (where available) with our self-reported dataset before we are required to submit data which may ultimately lead to some form of financial penalty.

Consultation question

- Do you support the proposal to include a sentinel events flag to improve the timeliness and consistency of data that is used for funding purposes?

In general terms Tasmania is of the view that the systematic reliance on self-reporting is inappropriate. Tasmania does not believe that the inclusion of a sentinel events flag will improve timeliness and consistency of data within an environment dependent upon 'self-reporting'. An agreed national approach for reporting including quality assurance and audit of data would be preferable.

Consultation question

- Do you agree with IHPA's assessment of this option (not funding episodes with a sentinel event)?

Tasmania agrees with IHPA's assessment of not funding episodes with a sentinel event subject to the issues raised in earlier responses.

Hospital Acquired Complications (HACs)

Section 11.6.1 Scope and Definition of HACs

Tasmania acknowledges that the final Australian list of HACs was developed over the last three years through a clinician led process.

Tasmania has identified a number of significant issues with the HACs list and believes the list should be the subject of a detailed review. Consequently it is recommended that the length of the shadow period be adjusted if necessary to accommodate the resolution of these issues prior to formal implementation. Detailed comments are provided at Attachment 2.

Section 11.6.2 Policy Context of Pricing and Funding models to reduce HACs

Tasmania is aware that the cost of treating episodes with HACs is substantially higher than non-HAC episodes. There is therefore already a substantial financial incentive for hospitals to minimise HACs (in addition to existing professional, moral and ethical incentives). Whichever HAC model is chosen, it must recognise the incentives already in existence, as the assumption that additional financial incentives are required may be flawed.

Section 11.6.4 Overview of approaches to pricing and funding of HACs

Risk-adjustment requires that the unavoidable risk of HACs, particularly for high-risk patients will still need to be funded, firstly by hospitals, and in the context of the Medicare principles, jointly funded by the Commonwealth and States. It would be inappropriate to remove HACs from the NEP as this will result in hospitals being underfunded and undermine Medicare. It is a question whether excess trimming already results in the NEP underestimating the true average cost of care and undermines the sustainability of safe care in hospitals.

Section 11.6.5 Episode-level, funding approaches to HACs

Option 1: Remove the HAC so that it does not contribute to DRG assignment

Consultation question

- What are the advantages and disadvantages of Option 1 which reduces the funding for some acute admitted episodes with a HAC?
- Do you agree with IHPA's assessment of this option?

This option would be easy to implement requiring changes to be made to the grouper, not every episode is affected and the overall impact is not significant. Where HACs are no longer included in the DRG assignment this may result in a change in the level of weighted activity for the LHN. To ensure that overall funding for the hospital system is maintained, any systemic reductions in weighting should be back-cast (potentially using the shadow-year) to ameliorate overall funding effects while retaining (marginal) incentive effects.

This option will deliver the least impact on Commonwealth funding at the state and territory level. However the adjustments would still have an impact on payments for individual episodes of care and potentially on the allocation of funds at hospital level. Consequently this model would incentivise good safety and quality at the hospital level while largely preserving aggregate funding at the State and Territory level.

Consideration should be given as to whether the DRG weighting of the activity impacted by the change should take into account any underlying patient factors that impact on the risk of a HAC occurring, and therefore the average anticipated cost of care.

This option should be considered as the option of choice, however it is acknowledged that there may be merit in penalty based options such as Option 2 which could influence behavioural change at the hospital level. A combined approach of both Options 1 and 2 may be considered in the longer term when systems have matured.

Section 11.6.6 Hospital-level, funding approaches to HACs

Option 2: Funding adjustments made on the basis of differences in HAC rates across hospitals

Consultation question

- What are the advantages and disadvantages of Option 2 that adjusts funding to hospitals on the basis of differences in their HAC rates?
- Do you agree with IHPA's assessment of this option?
- What are the advantages and disadvantages to the approach to risk adjustment?

Option 2 is not preferred as it is overly dependent on the risk-adjustment method and jurisdictional coding practices. Given that there are issues with both under and over compensation for risk there is no way of getting this 'right' under uncertainty. The funding implications are fundamentally contrary - hospitals with high HAC rates cannot be de-funded because of the risk of a downward safety spiral. A moral persuasion process that flags hospitals with high risk-adjusted HAC rates would be more appropriate.

A threshold model under which a hospital that sits slightly within or slightly outside the threshold faces substantially different penalties which would be inequitable and could create incentives to under-report HAC events and introduce patient selection and encourage a risk averse culture. A model of significant penalties for broad-based HAC rates could make it hard to recruit health professionals to hospitals that need them the most.

Nonetheless, in the longer term, this option may have merit in influencing behavioural change at the hospital level when combined as an adjunct to Option 1.

Section 11.6.7 Combined pricing and funding approaches to HACs

Option 3: A quality-adjusted NEP with funding incentives for hospitals with the lowest HAC rates

Consultation question

- What are the advantages and disadvantages of Option 3 that combines funding incentives and penalties?
- Do you agree with IHPA's assessment of this option?
- Are there any other pricing or funding options that IHPA should consider in relation to HACs?

Option 3 is not acceptable on the basis that most HACs are strongly correlated with risk-adjustment for age and are therefore difficult to avoid. Hospitals with low HAC rates are already likely to face lower costs of care and have a financial advantage. This does not need to be exacerbated, and indeed, may lead to

'gaming' of the system. This option is overly complex and does not provide an exact science that would lead to improvements in Safety and Quality.

An approach which reduced an already arbitrary price indicator for unavoidable costs just moves the NEP further away from a fair funding model under which the Commonwealth and State share the cost of public hospital services and undermines Medicare. A number of episodes with HACs are already excluded through the trimming process, so this would effectively duplicate this process and make the Medicare principle of free access more untenable for state public hospitals. Whilst Tasmania does not reject the concept of this option entirely, if funding is reduced as a consequence of pricing for Safety and Quality then it must be on the basis of the funding being retained for the explicit purpose of Safety and Quality improvement programs.

Section 11.6.8 responding to the Condition Onset Flag data quality issues

Consultation question

- How should IHPA treat hospitals with poor quality COF reporting?

Tasmanian hospitals follow the Australian Coding Standard 0048 Condition Onset Flag (COF) with the aim of a consistent and accurate assignment of the COF.

Tasmania is currently in the process of establishing a methodology to undertake analysis of COF reporting. Preliminary analysis of Tasmanian data has identified potential issues such as 'artificial' double counting in certain circumstances.

It may be useful for IHPA to undertake a body of national work to determine how best COFs should be defined and consistently reported by States and Territories.

Proposing funding reductions for poor COF reporting is inappropriate as Hospitals are already facing significant funding pressures while trying to improve service delivery and quality care. Increasing the relative priority of reporting by creating financial penalties for system and data issues sends the wrong signals (on prioritisation of care) and suggests that the underlying approach is flawed.

IHPA must ensure that the option chosen is the least dependent upon COF reporting if there are identified issues around poor quality reporting of the COF.

Avoidable Hospital Re-admissions

Section 11.7.3 Timeframe for measuring avoidable hospital re-admissions

Consultation questions

- What approach is supported for setting timeframes within which avoidable hospital re-admissions are measured?
- Is there Australian evidence (including guidelines or recommendations) that could be used to implement condition specific re-admission timeframes?

From a safety and quality perspective it's not about the timeframe but that the patient needed to return because of something that a hospital did, or failed to accurately do.

Tasmania does not support the premature commencement of pricing and funding models for avoidable hospital re-admissions on the basis that there is not yet an agreed list of conditions in place.

It would be preferable to allow the HACs processes to become mature and established ahead of measuring avoidable hospital readmissions, to ensure credibility of the robustness of the processes, which may in reality require a 2 to 3 year lead time.

A clinically led process, similar to the development of the HACs is recommended for the establishment of pricing and funding models for avoidable hospital readmissions.

In setting a time frame the definition of an avoidable hospital readmission and how it can be identified needs to be developed, together with a period of clinical analysis of the outcome before implementation.

Section 11.7.4 Re-admissions to the same hospital or other hospitals

Consultation question

- Is there support for pricing and funding models to be based on avoidable hospital re-admissions within the same LHN?

Tasmania does not support the premature commencement of pricing and funding models for avoidable hospital re-admissions on the basis that there is not yet an agreed list of conditions in place.

A model based on avoidable hospital re-admissions with the same LHN could be problematic in Tasmania if we are only focussing on issues when the patient returns to the original site. Some of the more worrying issues that have been noted are when a patient represents to another hospital because the patient had no faith in the original hospital or due to the fact that the original hospital could not actually deal with the further care required.

There is also a need for IHPA to establish a key principle in relation to avoidable re-admissions and the impacts that exist when the care is provided in both the public and private sectors.

Section 11.7.5 Incidence of avoidable hospital readmissions

It is noted that IHPA is not able to accurately quantify the number of episodes and the pricing and funding impact for avoidable hospital re-admissions, as the pricing and funding options for avoidable readmissions are less fully developed than is the case for pricing and funding options for sentinel events and HACs.

Section 11.7.7 Implementation of an approach for avoidable re-admissions

Consultation question

- When should a pricing and funding approach for avoidable re-admissions be implemented?

See comments above.

Implementing a Pricing and Funding Approach

Section 11.8.2 Evaluation

Consultation question

- What do you think are the most important considerations for implementation of pricing and funding approaches for safety and quality?
- Do you agree that IHPA would need to back cast the impact of introducing new measures for safety and quality into the pricing and funding models?

For Tasmania, the most important consideration is that we do not turn the focus to finances and away from a culture of reporting serious events, so that there are improvements to the services that are delivered.

Pricing and funding for safety and quality can improve outcomes if it is effective in changing clinicians' behaviour without causing adverse consequences. For complex approaches, the interplay of information and incentives can have unexpected and sometimes perverse effects. There is emerging recognition of the role of behavioural insights or 'nudge' in understanding, developing and improving policies to support improved outcomes. Under a behavioural insights approach, different approaches to inducing behavioural change are rigorously tested, including controls and alternative models. It is recommended that a behavioural insights approach be considered in relation to any complex information, incentive or disincentive based options, prior to implementation.

Important considerations for implementation of pricing and funding approaches for safety and quality should also include:

- Ease of implementation
- Minimise complexity
- Minimise gaming opportunities
- Risk adjustment methods
- Re-investing in safety and quality to ensure that the hospitals that have reductions in funding due to pricing for safety and quality don't end up with worse outcomes due to resource limitations from reduced funding
- Data capture (particularly for HACs)
- The method used to adjust for HACs/re-admissions
- Public/Private sector relationships
- Contracted out services

Tasmania agrees that IHPA would need to back cast the impact of these new measures. The National Health Reform Agreement (NHRA) requires that where IHPA makes significant changes to the activity based funding classification systems or methodologies, the effect of such changes must be back-cast to the year prior to their implementation for the purpose of the calculation of Commonwealth growth funding, as set out in the NHRA (clause A40, NHRA).

The IHPA back-casting policy also states that, for calculating the actual growth in Commonwealth funding, the Administrator should apply the current year price weights to the previous year's activity data, to ensure that methodological changes in the national pricing model are accounted for. Section 2.2.3 allows for material changes to pricing models to be factored into the back-casting of the prior year's activity data. The Administrator, as such would apply any adjustment for the impact in pricing and funding for safety and quality on the base year public hospital activity data to calculate base year National Weighted

Activity Units (NWAUs) and current year NWAUs for the purpose of calculating of Commonwealth growth funding. This would ensure that the model changes do not have a systematic effect on growth in NWAUs.

It is recommended that IHPA provide advice on the options for back-casting the impact of introducing new measures for safety and quality into pricing and funding models, ahead of implementation of the agreed approach.

Attachment 2.

The following comments are provided specifically in relation to the list of Hospital Acquired Complications (HACs) included within the IHPA Consultation paper.

It is recommended that each of the factors identified in the IHPA paper be subject to a thorough interrogation in relation to the literature of identification, causation and treatment of the putative “Hospital-Acquired Complications”.

Complication	Identifying diagnoses	Comments
Pressure Injury	Stage III ulcer Stage IV ulcer Unspecified decubitus ulcer and pressure area	It would be preferable for the identifying diagnoses to be defined as un-stageable rather than unspecified. In addition - See below ‘Commentary #1’ concerning pressure injury as an exemplar.
Falls resulting in fracture or intracranial injury	Intracranial injury Fractured neck of femur Other fractures	Intracranial injury should be defined to exclude injury to the scalp and external sensory organs (e.g. ear laceration).
Healthcare associated infection	Urinary tract infection Surgical site infection Pneumonia Blood stream infection Central line and peripheral line associated bloodstream infection Multi-resistant organism Infection associated with prosthetics/implantable devices Gastrointestinal infections	In relation to infection associated with prosthetics/implantable devices –clarification is required as to whether this refers to deep infection only or both superficial and deep infection. If superficial infection only; then this refers to a much larger group. Urinary tract infection is highly prevalent in aged, immobile patients in the (pre-hospital) community, including nursing homes. Diagnosis relies on microbiology and may not be apparent (or tested for) on admission. Bloodstream infection should be defined to exclude venous infection as phlebitis (venous inflammation) is a confounding factor. Gastrointestinal infections are non-specific. If this relates to contraction of a multiple antibiotic resistant enterococcal organism, this should be closely defined and specifically stated. Otherwise supported.

Complication	Identifying diagnoses	Comments
Surgical complications requiring unplanned return to theatre	<p>Post-operative haemorrhage/haematoma requiring transfusion and or return to theatre</p> <p>Surgical wound dehiscence</p> <p>Anastomotic leak</p> <p>Vascular graft failure</p> <p>Other surgical complications requiring unplanned return to theatre</p>	<p>Post-operative haemorrhage is expected in some conditions (e.g. chest drain tube after thoracotomy and pulmonary lobectomy).</p> <p>Otherwise supported.</p>
Unplanned Intensive Care Unit Admission	Unplanned admission to intensive care unit	Supported.
Respiratory complications	<p>Respiratory failure including acute respiratory distress syndrome requiring ventilation</p> <p>Aspiration pneumonia</p>	Respiratory failure including acute respiratory distress syndrome requiring ventilation – clarification is required as to whether this refers to adult and neonate or just adults.
Venous thromboembolism	<p>Pulmonary embolism</p> <p>Deep vein thrombosis</p>	Because of the elevated base rate in at-risk populations that cannot be completely excluded by NWAU, it is recommended that this be included as a preventable complication UNLESS there is evidence of preoperative thrombi prophylaxis assessment.
Renal failure	Renal failure requiring haemodialysis or continuous veno-venous haemodialysis	This should be detailed as renal failure for longer than a specific period (e.g. 14 days) or outside of an intensive care unit.
Gastrointestinal bleeding	Gastrointestinal bleeding	<p>Rectal bleeding can occur following diagnostic procedures (e.g. colonoscopy).</p> <p>The relationship of bleeding to poor quality of care is obscure and lacks face validity.</p>
Medication complications	<p>Drug related respiratory complications/depression</p> <p>Haemorrhagic disorder due to circulating anticoagulants</p> <p>Hypoglycaemia</p>	<p>It is recommended that this definition include severe allergic reaction to a previously known drug allergy</p> <p>Hypoglycaemia is a characteristic of brittle diabetes as well as poorly controlled diabetes. There is a significant problem of causation.</p>
Delirium	Delirium	The development or altered consciousness is a correlate of serious metabolic disturbance and known risk factors (e.g. pre-existing cognitive

Complication	Identifying diagnoses	Comments
		<p>impairment).</p> <p>It has been a major safety and quality commission initiative to introduce this as a safety standard.</p> <p>Best practice public policy would be to encourage awareness and reporting only in the first instance.</p>
Persistent incontinence	Urinary incontinence	<p>This category should only be introduced in relation to male patients who have undergone prostatectomy in the first instance.</p> <p>Persistent incontinence arising from catheterisation injury is an extremely low prevalence phenomenon.</p>
Malnutrition	Malnutrition	<p>Coding for malnutrition should not be the subject of any penalty, for the reasons noted above in relation to “Delirium”.</p> <p>Malnutrition can arise from the cachexia associated with cancer; chemotherapy associated with cancer or as a symptom of severe depression. None of these are accidentally hospital-caused.</p>
Cardiac complications	<p>Heart failure and pulmonary oedema</p> <p>Arrhythmias</p> <p>Cardiac arrest</p> <p>Acute coronary syndrome including unstable angina,</p> <p>ST- elevation myocardial infarction and Non – ST – elevation myocardial infarction</p>	<p>The position that the dominant cause of inpatient arrhythmias are is a poor standard of care in hospitals is NOT tenable.</p> <p>See “Commentary #2” in relation to heart failure in Tasmania.</p>
Third and fourth degree perineal laceration	Third and fourth degree perineal laceration during delivery	Strongly supported.

Complication	Identifying diagnoses	Comments
during delivery		
Neonatal birth trauma	Neonatal birth trauma	Strongly supported.

COMMENTARY #1 – EXAMPLE OF PRESSURE INJURIES/ ULCERS

Pressure ulcers serve as a paradigm for a number of observations made in relation to the proposed “Hospital-Acquired Complications”.

The recommended review of putative “Hospital-acquired complications” uses simply as an example and highlights pressure injury data drawn from the attached study by Gunningberg & Stotts (2008) *Tracking quality over time: what do pressure ulcer data show?* International Journal for Quality in Health Care 2008; Volume 20, Number 4: pp. 246–253.

- **Prevention Possible in Hospitalisation Timeframe:** Population characteristics should lead to risk adjustment, but there should be NO risk-adjustment for factors remediable in the course of an acute hospitalisation:
 - Age is a significant correlate of the likelihood of developing pressure ulcers (see attached prevalence study of a 1100 bed hospital, before and after a targeted quality intervention). It is not remediable before, after or during hospitalisation.
 - Pressure ulcers across time were present in about 1 in 4.5 patients, and the prevalence did not decrease despite a comprehensive quality improvement program in a 1100 bed Swedish Hospital.
- **Dominant Causation Is Demonstrably from Poor Inpatient Care:** The identified complication should have a clear aetiological pathway in the dominant cause should be iatrogenic (hospital-caused):
 - Incontinence and immobility (e.g. being wheelchair-bound) are important and often pre-admission correlates of pressure injuries.
 - The scientific rule of parsimony requires that the smallest number of factors be viewed as causative where a number of potential factors are closely correlated.
- **High Positive Predictive Value to Clinician Assessment:** The identified complication should be capable of being ‘diagnosed’ by an average clinician, with a low Type I error (‘false positive’) rate.
 - The ability to make a true positive diagnosis across an inpatient cohort also depends upon high inter-rater reliability with other clinicians. It also depends on the background rate of a particular ‘diagnosis’ in the host population (here, pressure injuries in non-hospitalised community members). The formula for positive predictive value appears below.

$$PPV = \frac{\text{number of true positives}}{\text{number of true positives} + \text{number of false positives}} = \frac{\text{number of true positives}}{\text{number of positive calls}}$$

COMMENTARY #2 - HEART FAILURE

The detection of heart failure in relation to an inpatient’s episode of care must be set against the background prevalence of that condition in the community (see attached article #2, Chan et al. (2016) *‘Current and projected burden of heart failure in the Australian adult population: a substantive but still ill-defined major health issue’*, BMC Health Services Research 16:501).

In relation to Tasmania, there is an overrepresentation of heart failure. In comparison with the Australian average, this represents a burden of 1572 cases more than would be expected on Australia wide admission figures.

When coded, this could represent a significant financial penalty to Tasmania, with a 10% discount applied.

As the attached article (#2) makes clear, the true prevalence of this problem is ill-defined, with potential misattribution to the condition being “hospital-acquired”.

What is clear is that the costs to health systems of heart failure are increasing and these should not be the subject of discount. For example, Tran et al (2016) noted:

“As in other developed countries, hospital costs related to heart failure in Canada are on the rise. Older adults are the main consumers of such hospital services”.

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Tracking quality over time: what do pressure ulcer data show?

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Abstract

Objective. To compare the prevalence of pressure ulcers and prevention before and after a quality improvement program; determine whether patient characteristics differed for those who did and did not develop pressure ulcers; identify pressure ulcer prevention implemented at admission and whether prevention and risk factors varied by pressure ulcer severity.

Design. Descriptive comparative study based on two cross-sectional pressure ulcer surveys conducted in 2002 and 2006, complemented with a retrospective audit of the electronic health record and administrative system for patients identified with pressure ulcers.

Setting. 1100-bed Swedish university hospital.

Participants. 612 hospitalized patients in 2002 and 632 in 2006.

Main outcome measures. Prevalence of pressure ulcers and prevention (pressure-reducing mattresses; planned repositioning; chair, heel and 30° lateral positioning cushions).

Results. Pressure ulcer prevalence was 23.9% in 2002 and 22.9% in 2006. When non-blanchable erythema was excluded, the prevalence was 8.0 and 12.0%, respectively. The use of pressure-reducing mattresses increased while planned repositioning decreased. Those who developed ulcers were older, at-risk for ulcers, incontinent and had longer length of stay. Little prevention was documented at admission. Some prevention strategies and risk factors were related to severity of ulcers.

Conclusions. Pressure ulcer prevalence did not decrease, despite a comprehensive quality improvement program. Special attention is needed to provide prevention to older patients with acute admission. Skin and risk assessment, as well as prevention, should start early in the hospitalization. Identifying those persons with community-acquired versus hospital-acquired ulcers will strengthen pressure ulcers as an accurate marker of quality of care for hospitalized patients. If possible, data should be reported by ward level for comparison over time.

Keywords: hospitals, pressure ulcer, prevention, quality indicators, risk assessment

Introduction

Patient safety and quality of care are high on the healthcare agenda [1]. Pressure ulcers have long been used as a quality indicator of nursing care. Pressure ulcer prevalence studies are being currently used in many institutions around the world to monitor quality of care [2, 3]. The prevalence of pressure ulcers is high in hospitalized patients. In the United States, large datasets ($n = 17\,510$ to $n = 31\,969$) show a pressure ulcer prevalence between 14 and 17% [4]. A Canadian study reports a prevalence of 25.1% in acute care ($n = 4831$) [5] and across European settings (Belgium, Italy, Portugal, UK and Sweden), the prevalence is 18.1% in hospitals ($n = 5947$) [6]. Pressure ulcers are a problem because they cause suffering

[7, 8] and increase healthcare costs [9, 10]. Efficient comprehensive improvement work is needed to reduce the prevalence of pressure ulcers in hospitalized patients [10].

In Sweden, pressure ulcers have not routinely been a hospital-level quality indicator. However, pressure ulcer prevalence was evaluated in 2002 in a Swedish university hospital using the European Pressure Ulcer Advisory Panel methodology [6]. Of the patients surveyed ($n = 612$), 23.9% had pressure ulcers [11]. A comprehensive hospital-wide quality improvement plan was developed and undertaken that addressed pivotal aspects of pressure ulcer prevention (Table 1). The prevalence was subsequently reevaluated in 2006. This paper provides a snapshot of the pressure ulcer status prior to and after the quality improvement program

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Table 1 Pressure ulcer prevention after prevalence survey 2002

Activity	Time	Reference
Information and education		
Information to all head nurses.	2002–06	
Educational program and seminars for registered nurses and nurse assistants.	2002–06	
Networking for pressure ulcer nurses.	2002–03	
Web-based program (PUCLAS) for pressure ulcer classification for registered nurses and nurse assistants.	2003–06	www.epuap.org
Risk and skin assessment mandatory for nursing students.	2002–06	[25]
Development of clinical guidelines		
Guidelines for purchase and allocation of pressure-reducing mattresses.	2002	
Multidisciplinary clinical guidelines developed by a work group for the county (university hospital, county hospital, primary care and community settings).	2005–06	www.akademiska.se
Documentation		
Comparison of the accuracy and quality of the documentation of pressure ulcers between physical examination of patients and audit of patient record content.	2003	[26]
Templates for risk assessment, pressure ulcer grading and standard care plans were developed to facilitate adequate documentation in the electronic health record.	2003	
Mandatory use of the templates for pressure ulcer grading in the electronic health record both in admission and discharge notes in nine surgical wards.	2005	[27]
Quality indicator–improvement		
The EPUAP prevalence survey was repeated in the three departments with highest prevalence (orthopedic/surgery, medical, geriatric). Fast feedback of results.	2004	[28]
Pressure ulcer identified as a quality indicator on hospital level. Mandatory annually reporting of pressure ulcer prevalence.	2004	
Workgroup commissioned by the County council to develop a model for feedback of pressure ulcer incidence from the electronic health record.	2005–06	
Actions (Plan-Do-Study-Act) performed on department level.	2002–06	

and provides insights into factors that contribute to the post-implementation pressure ulcer status.

The aims of the study were to:

- (i) compare pressure ulcer prevalence and prevention in a university hospital before and after implementation of a pressure ulcer quality improvement program,
- (ii) determine whether the patient characteristics differed for those who did and did not develop pressure ulcers,
- (iii) identify pressure ulcer prevention implemented at admission, and
- (iv) determine whether prevention and risk factors varied by pressure ulcer severity.

Method

Design

The data for this descriptive comparative study come from two cross-sectional pressure ulcer surveys conducted in 2002 and 2006. Both datasets were utilized to address the first study aim. The 2006 survey data were used to examine the remaining study aims, complemented with a retrospective audit of the electronic health record and the administrative system for patients identified with pressure ulcers.

Sample

The sample included all patients, 18 years and older, admitted to a 1100-bed university hospital before midnight the day of the survey. All inpatient areas were surveyed except psychiatry, day care, maternity and hospice. In addition, 120 eligible patients (16.4%) in 2002 and 92 patients (12.7%) in 2006 were not included because they were not available for inspection in the ward or they refused to participate.

Measures/instruments

Prevalence was defined as the number of persons with pressure ulcers detected by physical examination on the survey day. The EPUAP prevalence methodology was used for the physical examination [6]. Pressure ulcers were defined using the EPUAP criteria [6].

- (i) Grade 1: non-blanchable erythema of intact skin;
- (ii) Grade 2: partial-thickness skin loss involving epidermis, or dermis, or both;
- (iii) Grade 3: full-thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia; and

- (iv) Grade 4: full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone or supporting structures. Necrotic ulcers are classified as Grade 4 [6].

Pressure ulcer severity increases from Grade 1 to 4.

Prevention was defined as the use of pressure-reducing mattresses, chair cushions and planned repositioning in bed and chair observed at the time of the physical examination. In the 2006 survey, cushions for 30° lateral positioning and heel cushions were added. In the retrospective audit of records, documented information regarding prevention was used.

Pressure ulcer risk was assessed with the Braden Scale and the incontinence subscale of the Norton scale [6]. A total Braden score <17 was defined as at risk for pressure ulcer development. In the audit of records, risk assessment was defined as either documentation of clinical judgment 'at-risk' or findings of risk using a validated risk assessment tool.

Patient characteristics in the survey included age, gender, expected length of stay and department. In the retrospective audit, information was abstracted from the administrative system on primary and secondary diagnoses, admitted from home or not, acute or elective admission (acute admission was through the emergency department), not cared for in usual ward, surgery, length of stay in the hospital, and whether the patient died within 7 months. Data were obtained from the electronic health record on the hemoglobin, blood pressure (BP) and time in the emergency department. For documentation of pressure ulcer, notes from all professionals were searched with the key word 'Skin', 'Pressure Ulcer' or 'Ulcer'.

A standardized data-collection form was utilized in the survey [6]. An additional one-page data-collection form was developed for the retrospective audit of the electronic health record and the administrative system.

Procedure

Permission for the study was obtained from the medical director at the hospital. The patients received verbal and written information about the study and gave verbal consent. All data were treated confidentially. Participants were free to withdraw at any time. Approval was obtained from the Research Ethics Committee of the Faculty of Medicine at Uppsala University (No. 01-502).

For both prevalence studies, each patient was visited by a team of two registered nurses, i.e. a specially trained data collector (non-ward nurse) and a staff nurse (ward nurse). The patient's skin was assessed, the Braden scale was completed, and preventive strategies were recorded. If there was a disagreement about the pressure ulcer grade, the decision was made by the non-ward nurse.

Prior to each survey day, all nurses participating in the prevalence survey attended a half-day training on the survey procedure. Each nurse graded 10 color photos of pressure ulcers. Inter-rater reliability examined with Cohen's kappa was 0.82 ($n = 22$) in 2002 and 0.78 ($n = 52$) in 2006, which was judged to be excellent agreement [12]. After the inter-rater reliability was tested, additional education was provided

by reviewing each photograph and discussing the criteria for its pressure ulcer grading.

For the 2006 survey, two experienced Quality Coordinators, prior head nurses with special training in the electronic record use and the administrative system, conducted the retrospective audit for patients identified with pressure ulcers.

Data analyses

Study data were analyzed using SPSS (version 14.0) and were explored descriptively. To compare groups, Student's *t*-test was used for continuous variables, Mann-Whitney *U*-test for ordinal scale variables, and Chi-square for dichotomous variables. A *P*-value of <0.05 was considered statistically significant.

Results

Comparison of pressure ulcer prevalence and prevention: 2002 and 2006

Over 600 patients were included in each prevalence study ($n = 612$ in 2002; $n = 632$ in 2006). There were no significant differences between the groups in gender, age, type of unit or risk status (Braden subscales or total score). Expected length of stay was significantly shorter in 2006 ($P = 0.002$) (Table 2).

The prevalence of all pressure ulcers (Grade 1–4) was 23.9% in 2002 and 22.9% in 2006. When Grade 1 pressure ulcers were excluded, the prevalence rates were 8.0 and 12.0%, respectively (Table 3), which reveals a significant increase ($P = 0.018$) from baseline to the second survey. On the other hand, the mean number of ulcers per patient decreased significantly from 1.9 in 2002 to 1.6 in 2006 ($P = 0.02$). In both years, the sacrum and heels were the most common locations. However, in 2006, 'other locations', e.g. elbows, ears and feet, have increased ($P = 0.02$). The use of pressure-reducing mattresses increased significantly ($P < 0.001$) from 25.3% in 2002 to 41.1% in 2006. Planned repositioning in the bed or chair as well as the use of a pressure-reducing cushion in the chair were used sparsely in both years and decreased significantly over time, i.e. repositioning in bed ($P = 0.02$), chair ($P = 0.01$) and pressure-reducing cushions ($P = 0.02$).

Characteristics of those who did and did not develop pressure ulcers in 2006

Patients with pressure ulcers ($n = 145$) were compared with those without ulcers ($n = 487$). Patients with pressure ulcers were significantly older (mean age 77 versus 66 years; $P < 0.001$), had lower scores on all Braden subscales ($P < 0.001$), total Braden score ($P < 0.001$), and more incontinence ($P < 0.001$) than patients without pressure ulcers. They also had significantly longer hospital stay prior to the survey (mean number of days 16 versus 10 days on that specific ward; $P < 0.001$). Patients with a pressure ulcer received pressure-reducing mattresses ($P < 0.001$) and planned repositioning ($P < 0.001$) more frequently than patients without pressure ulcers.

Table 2 Patient characteristics in 2002 and 2006

	2002		2006		<i>P</i> -value
	<i>(n</i> = 612)		<i>(n</i> = 632)		
	<i>n</i>	%	<i>n</i>	%	
Gender					
Women	302	49.3	324	51.3	0.81
Men	295	48.2	308	48.7	
Missing data	15	2.5	–	–	
Age					
18–39	53	8.7	45	7.1	0.49
40–59	147	24.0	136	21.5	
60–69	98	16.0	127	20.1	
70–79	123	20.1	141	22.3	
80–89	153	25.0	137	21.7	
> 89	33	5.4	46	7.3	
Missing data	5	0.8	–	–	
Expected hospital stay					
< 6 days	143	23.4	202	32.0	0.002
> 6 days–1 month	343	56.0	307	48.6	
> 1 month	110	18.0	97	15.3	
Type of unit					
Acute department	496	81.0	512	81.0	0.56
Intensive department	30	4.9	24	3.8	
Geriatric department	86	14.1	96	15.2	
Risk assessment					
Braden score <17	137	22.4	155	24.5	0.28

Most of the patients (77.2%) with pressure ulcers had an acute admission and were admitted from home. One-third of the patients in the emergency department and in the operating room stayed there more than 4 h. Although the majority of patients were older (75.2%, ≥ 70 years), 25% of the patients with pressure ulcers were younger. Patients with pressure ulcers were present on all of the wards. Twenty-eight patients (20.5%) died within 7 months after the survey. At hospital admission, mean systolic BP was 132.7 (SD 28.6), mean diastolic BP was 73.8 mmHg (SD 13.7) and mean hemoglobin was 124.6 mg/l (SD 19.4).

Patients with pressure ulcers were admitted for varied reasons. Most common were admission for rehabilitation ($n = 27$), neurological conditions ($n = 21$), fractures ($n = 17$), circulatory conditions ($n = 14$), infection ($n = 12$) and malignancy ($n = 11$). Only two patients were admitted primarily for pressure ulcer treatment. Many patients had multiple secondary diagnoses (range 1–10), with the mean and median being 4.0.

Pressure ulcer prevention implemented at admission: 2006

Of the 145 patients with pressure ulcers, 136 records were audited. In nine cases, patients' identity numbers were not correct, and it was not possible to find the records. Skin

Table 3 Pressure ulcer prevalence and prevention in 2002 and 2006

	2002		2006		<i>P</i> -value
	<i>(n</i> = 612)		<i>(n</i> = 632)		
	<i>n</i>	%	<i>n</i>	%	
Pressure ulcer					
Grade 1	97	15.8	69	10.9	0.97
Grade 2	20	3.3	48	7.6	
Grade 3	17	2.8	14	2.2	
Grade 4	12	2.0	14	2.2	
Total	146	23.9	145	22.9	
Location of most severe pressure ulcer					
Sacrum	65	44.5	54	37.2	0.002
Heel	54	37.0	41	28.3	
Hip	5	3.4	1	0.7	
Other	17	11.6	41	28.3	
Missing data	4	2.7	8	5.5	
Prevention in bed					
Pressure-reducing mattress	155	25.3	260	41.1	<0.001
Planned repositioning	85	13.9	61	9.7	
Prevention in chair					
Pressure-reducing cushion	66	10.8	44	7.0	0.02
Planned repositioning	37	6.0	17	2.7	

inspection was recorded in the admission note on 56 patients (41.2%). Twenty patients (3.2%) were identified with pressure ulcers, but only three were described in sufficient detail that pressure ulcer grade could be determined (two Grade 1 and one Grade 3). Risk assessment was documented for a fourth of the patients and only a few used a validated instrument. Only one patient received a pressure-reducing mattress, another 30° lateral positioning cushion, three had a heel cushion, and five had planned repositioning.

During hospitalization and prior to the survey, 18 patients were identified with a new pressure ulcer, thus 38 patients (6.0%) had pressure ulcers when they arrived on the ward where the survey was conducted. On the survey day, 145 (22.9%) had ulcers.

Prevention and risk factors by pressure ulcer severity: 2006

When prevention of those with Grade 1 ulcers was compared with that for more severe ulcers (Grades 2, 3 and 4), those with more severe ulcers had significantly more pressure-reducing mattresses ($P < 0.001$), cushions for 30° lateral positioning ($P = 0.001$), and heel cushions ($P = 0.01$). Interventions rarely used and that did not differ significantly by severity were planned repositioning in bed, chair cushions and repositioning in chair. Seat cushions were used mainly in the geriatric department.

Table 4 Braden scores and incontinence scores by pressure ulcer grades in 2006

	Grade 1	Grade 2–4	Total		<i>P</i> -value	No pressure ulcer (<i>n</i> = 487)	
	(<i>n</i> = 69)	(<i>n</i> = 76)	(<i>n</i> = 145)			<i>n</i>	%
	<i>n</i>	<i>n</i>	<i>n</i>	%			
Sensory perception							
1. Completely limited ^a	2	4	6	4.1	0.11	7	1.4
2. Very limited ^a	8	10	18	12.4		30	6.2
3. Slightly limited	22	32	54	37.2		72	14.8
4. No impairment	36	29	65	44.8		378	77.6
Moisture							
1. Constantly moist ^a	0	4	4	2.8	0.003	1	0.2
2. Very moist ^a	4	11	15	10.3		17	3.6
3. Occasionally moist	24	31	55	37.9		71	15.0
4. Rarely moist	38	26	64	44.1		383	81.0
Activity							
1. Bedfast ^a	14	32	46	31.7	0.001	65	13.4
2. Chair fast ^a	20	25	45	31.0		57	11.8
3. Walks occasionally	25	14	39	26.9		123	25.4
4. Walks frequently	9	5	14	9.7		239	49.4
Mobility							
1. Completely immobile ^a	3	12	15	10.3	<0.001	10	2.1
2. Very limited ^a	16	34	50	34.5		82	16.9
3. Slightly limited	33	22	55	37.9		137	28.2
4. No limitation	15	8	23	15.9		257	52.9
Nutrition							
1. Very poor ^a	7	10	17	11.7	0.59	21	4.3
2. Probably inadequate ^a	24	26	50	34.5		84	17.4
3. Adequate	27	32	59	40.7		170	35.1
4. Excellent	10	8	18	12.4		209	43.2
Friction and Shear							
1. Problem ^a	12	30	42	30.0	0.001	36	7.4
2. Potential problem	31	32	63	43.4		62	12.8
3. No apparent problem	25	14	39	26.9		387	79.8
Total score <17	27	43	80	55.2	<0.001	75	16.1
Incontinence							
1. Urine and feces ^a	9	16	25	17.2	0.11	19	3.9
2. Usually/urine ^a	5	5	10	6.9		22	4.6
3. Occasional	4	8	12	8.3		22	4.6
4. Not	50	45	95	65.5		420	87.0

^aHigh risk for each risk factor.

The total Braden scores showed that 80 of 145 patients (55.2%) with pressure ulcers were at risk (Table 4). However, 91 patients (62.8%) were bed or chair fast, 65 (44.8%) had very limited mobility or were completely immobile, and 42 (29.0%) required moderate to maximum help with bed or chair repositioning. Patients with more severe ulcers experienced greater moisture ($P = 0.003$), were more often bed or chair fast ($P < 0.001$), immobile ($P < 0.001$), and had issues of friction and shear ($P = 0.001$).

Discussion

Pressure ulcers across time were present in about 1 in 4.5 patients, and the prevalence did not decrease despite a comprehensive quality improvement program. When grade 1 ulcers were excluded, the prevalence of ulcers remained high (8% in 2002 and 12% in 2006), although less than that seen in other studies [4]. It is disappointing that the quality improvement program did not result in a decreased prevalence of pressure

ulcers. The methodology recommended by the European Pressure Ulcer Advisory Panel is a point prevalence survey and does not gather data for the origins of any pressure ulcers. Thus, these findings may reflect only the nature of patients admitted to the hospital, and not necessarily the care provided during hospitalization. This raises the question of whether prevalence is a good measure of quality of care [10, 13]. Furthermore, the retrospective audit of the electronic health record revealed a lack of documentation of skin assessment on admission to the hospital, thus it was impossible to decide whether the pressure ulcers were hospital-acquired or not. It is crucial to have a methodology that is both reliable and relatively easy to conduct for regular feedback to the clinicians.

A similar study from a 900-bed hospital in the Netherlands found a significant decrease in Grade 1–4 hospital-acquired pressure ulcers from 18 to 11% ($P < 0.001$) after implementing a hospital guideline for pressure ulcer care including a visco-elastic foam mattresses [14]. However, their sample was younger than ours and skin assessment was only performed on patients 'at-risk', which could mean an underestimation of ulcers due to lack of detection. Several quality improvement reports show examples of success, but often they do not report pressure ulcer grades, reliability of the data collection or patient demographics [10, 13].

Successful implementation of change can be explained by the relationship among evidence, context and facilitation [15]. The organizational context, including leadership and culture, is highlighted as it influences priorities and investments [16]. In the hospital studied, the focus for the last few years has been on two issues: major reorganization of departments and nursing leadership and implementation of the electronic health record. Educational priorities were on facilitating documentation by all professionals in the computerized system, limiting time and energy for substantive focus on pressure ulcer prevention. Another possible explanation for our findings is that improvements in one department were offset in another. A parallel study shows that the incidence of pressure ulcers in our orthopedic ward decreased from 55% in 1997 to 18% in 2006, after stepwise introduction of risk and skin assessment, pressure-reducing mattresses, education and nutritional guidelines [17] (A.-K. Westerlund *et al.*, submitted). Because of the reorganization, it was not possible to compare data at the ward level.

When analyzing the patients with pressure ulcers in detail, it is evident that more than 75% were 70 or older, had acute admissions, were admitted from home, and over 40% had surgery during their hospital stay. These findings are confirmed by others [18, 19]. Patient with pressure ulcers spent more days in the hospital had multiple co-morbidities and a high post-survey death rate. This suggests that patients were frail, lacked biological reserves, required complex medical treatment, and were at risk of pressure ulcers as an iatrogenic consequence of hospitalization [20]. Most (77%) had acute admission, and yet only 41% had admission skin assessment. Very few patients received prevention from the start of their hospitalization.

When care at admission was compared with that on the survey day, more prevention was provided on the survey day. However, it was not possible to identify the timing of mattress

use (prior to or following ulcer identification). Over the 4-year period, the mean number of ulcer per patient decreased, but the existing ulcers were slightly deeper. This might be explained by a decrease in planned repositioning and use of chair cushions, although the use of pressure-reducing mattresses significantly increased. These findings show that it is important to emphasize to staff that regular repositioning and heel-protection is needed, even when the patient lies on a pressure-reducing mattress. Findings from this study are consistent with those of De Laat *et al.* [14], who found that despite implementing a hospital guideline for pressure ulcer prevention, repositioning did not increase. Repositioning is central to prevention [21], yet the issue is how to translate science into practice. A recent systematic review revealed that little is known about how to increase research use in nursing [22].

The Institute for Healthcare Improvement in the United States recommends an 'all-or-none' format, meaning that all of the following should be performed: risk assessment, inspect skin daily, moisture management, optimal nutrition, repositioning and use of pressure-relieving surfaces [10]. However, Table 4 shows that patients with pressure ulcers have different risk factors. As expected, our data also show that patients with ulcers received pressure-reducing mattresses and planned repositioning more often than those without ulcers. Individual plans must be tailored to the patient's specific risk factors. Resources for care also need to be considered. Patient and family participation is pivotal in the development and implementation of a prevention plan, yet their role has not been addressed. Studies are needed that document positive outcomes, regardless of whether individual or bundles of interventions are utilized.

The issue of when to initiate prevention remains. Vanderwee *et al.* [23] found no significant difference in the prevalence of pressure ulcers when prevention was initiated by a Braden score < 17 or when a Grade 1 pressure ulcer appeared. Further research is needed to determine what the trigger should be for prevention.

It is important to realize that while the bedside care of turning and positioning patients is primarily a nursing responsibility, pressure ulcer prevention extends beyond nursing and includes the multidisciplinary team. Each profession has a responsibility, e.g. dieticians for assessing nutritional need, physiotherapists for complex mobility issues, physicians for medical issues, etc. [24].

Methodological strengths and limitations

The prevalence methodology used in this study is widely used in Europe and similar to that used in pressure ulcer prevalence studies across the globe. The data collectors were educated in the methodology, and the inter-rater reliability of the pressure ulcer grading was excellent prior to the study. Data were based on the examination of the patient by two registered nurses, which strengthen the validity and reliability of the observations. However, this prevalence study methodology does not provide a way to determine the incidence of pressure ulcers. Thus, effects of prevention cannot be fully known.

The data on prevention on admission were based on retrospective audit of the electronic health records, and it is possible that more prevention was provided than documented. Data from records are limited by the fact that they are self-reports; however, they are also legal documents and are expected to accurately reflect care provided.

Conclusion

Pressure ulcer prevalence did not decrease, despite a comprehensive quality improvement program. Those who developed ulcers were older, at risk of ulcers, incontinent and had longer length of stay. Increased use of pressure-reducing mattresses during the 4-year period reflected the adoption of evidence-based practice [21]. Risk factors for those with more severe ulcers were increased moisture, decreased activity, limited mobility and problems with friction. Major reorganization and implementation of an electronic health record may have negatively influenced the quality improvement program; further research on this is needed.

Data show that special attention is needed to provide prevention to older patients with acute admission. Thus, skin and risk assessment, as well as prevention, should start early in the hospital stay. Increasing the data collection to identify those patients with community-acquired versus hospital-acquired ulcers will strengthen pressure ulcers as an accurate marker of quality of care for hospitalized patients. If possible, data should be reported on ward level for comparison over time.

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RESEARCH ARTICLE

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Current and projected burden of heart failure in the Australian adult population: a substantive but still ill-defined major health issue

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Abstract

Background: Comprehensive epidemiological data to describe the burden of heart failure (HF) in Australia remain lacking despite its importance as a major health issue. Herewith, we estimate the current and future burden of HF in Australia using best available data.

Methods: Australian-specific and the most congruent international epidemiological and health utilisation data were applied to the Australian population (adults aged ≥ 45 years, 8.9 of 22.7 million total population in 2014) on an age and sex-specific basis. We estimated the current incident and prevalent cases of clinically overt/symptomatic HF (predominately those with reduced ejection fraction), hospital activity (diagnosis of HF as a primary or secondary reason for admission) and health care costs in 2014 and future prevalence and burden of HF projected to 2030.

Results: We estimated that over 61,000 (6.9 per 1000 person-years) adult Australians aged ≥ 45 years (58 % women) are diagnosed with HF with clinically overt signs and symptoms every year. On a conservative basis, 480,000 (6.3 %, 95 % CI 2.6 to 10.0 %) Australians (66 % men) are now affected by the syndrome with > 150,000 hospitalisations in excess of 1 million days in hospital per annum. The annual cost of managing HF in the community is approximately \$900 million and nearly \$2.7 billion (\$1.5 versus \$1.2 billion, men versus women) when considering the additional cost of in-patient care. We predict that the prevalence and future burden of HF will continue to increase over the next 10–15 years to nearly 750,000 people with an estimated annual health care cost of \$3.8 billion.

Conclusions: Australia is not immune to the growing magnitude and implications of a sustained epidemic of HF in an ageing population. However, its public health and economic burden will remain ill-defined until more definitive Australian-specific data are generated.

Keywords: Heart failure, Prevalence, Incidence, Economic burden

Background

Heart failure (HF) is one of the most prevalent cardiovascular diseases worldwide and is routinely attributed to be the leading cause of hospitalisation in persons aged ≥ 65 years [1]. Despite a relative paucity of specific information (from its epidemiology to health care episodes), Australia is not immune to this significant public

health issue. More than a decade ago, we estimated that approximately 325,000 adult Australians (4.5 % of those aged ≥ 45 years) were directly affected by this complex syndrome with around 100,000 hospital admissions per annum attributable to HF overall [2]. Ominously, for the Australian health care system, we also identified around 214,000 Australians with asymptomatic left ventricular systolic dysfunction at that time and have tracked residually high levels of antecedent risk for developing the syndrome; particularly relating to remnant high blood pressure levels in the community [3] and suboptimal

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levels of hypertension management in primary care [4]. At the same time, the Australian population has not only expanded but progressively aged since our last HF burden estimates. The latter becomes an increasingly important factor when considering the scope of HF has evolved with increasing awareness and recognition of HF associated with preserved ejection fraction (HFpEF - particularly among older women with a history of hypertension) [5]. This clinical entity remains problematic both in terms of diagnosis and treatment [6, 7]. In this context, HF with reduced ejection fraction (HFrEF) [6] remains a major clinical and public health focus with the efforts to improve its detection and treatment continuously evolving.

Importantly, since our last set of estimates (largely reliant on international data), a number of recent Australian-specific studies relating to the population prevalence of HF (notably the Canberra Heart Study [8]) and HF-related hospital activity (the West Australian linked data resource [9]) have provided a greater certainty around the epidemiological profiling of the syndrome when extrapolated to the latest and projected population figures for the whole of Australia [10, 11]. For the purpose of this study, we largely focused on incident and prevalent cases of HFrEF with or without a component of diastolic dysfunction (the hallmark of HFpEF) within the Australian population whilst providing some estimates of the likely burden imposed by HFpEF alone.

Study aims

Based on the changing population dynamics and more Australian-specific data, we aimed to produce a more accurate set of figures (from its population profile to hospital and community care activity) to describe various aspects of the contemporary burden of HF (as noted, predominantly that associated with systolic dysfunction as evidenced by reduced left ventricular ejection fraction) in Australia.

Methods

All data sources had appropriate ethics approval and this study was conducted according to the principles outlined in the Declaration of Helsinki [12].

Investigational strategy and data sources

To conservatively estimate the current incident and prevalent cases of HFrEF in the Australian adult population (aged ≥ 45 years), we evaluated a combination of validated Australian-specific and international peer-reviewed epidemiological and clinical trial datasets (see Table 1). These were applied to the latest Australian Bureau of Statistics population figures according to geographic locale on an age and sex-specific basis [10]. Based on our previously published reports [2, 13], this represents a validated method for estimating the burden of HF in Australia [2] and beyond [13]. Consistent with this approach, the

following were applied when selecting data to shape our burden estimates: 1) original Australian data (via a systematic review of the literature and in consultation with a panel of Australian HF clinical research academics/experts) were utilised [8, 9] in preference to overseas data; 2) preference was given to the most comprehensive and contemporary datasets or according to the purpose it was best suited, this included use of Western Australia linked data [9] to estimate new/*de novo* HF-related admissions as opposed to the broader New South Wales data [14] describing all primary and secondary admissions for HF per annum; and 3) where there were no contemporary Australian-specific data available, the most congruent international data were identified and utilised [15–17].

Population profile

We obtained the Australian Bureau of Statistics Australian population data on an age and sex-specific basis and according to geographic locale as at June 2014 [10]. Data for all persons aged ≥ 45 years (8,864,528) were grouped into 10-year age brackets except for those aged ≥ 75 years, who were treated as a single group. This was undertaken for both men and women and for each Australian State and Territory.

Incident and prevalent cases

Incident cases were defined as the annual number of new/*de novo* cases of HF predominantly associated with HFrEF (where individuals must present with appropriate symptoms and anomalies in the underlying cardiac structure and function associated with systolic dysfunction as evidenced by reduced left ventricular ejection fraction) and calculated by applying annual age and sex-specific incidence rates derived from international incidence statistics [15, 16] to the Australian Bureau of Statistics 2014 Australian population by 10-year age groups. Similarly, prevalent cases were defined as the combined total of new/*de novo* and surviving/pre-existing cases of HFrEF and calculated based on an annual point prevalence basis using a combination of Australian [8] and international [16, 17] prevalence data.

Hospital activity

A broad range of parameters pertaining to HF-related hospitalisations (confirmed by the International Classification of Diseases 9th edition [ICD-9] and 10th edition [ICD-10] diagnostic codes for HF) were derived from Australian-specific data alone [9]. This includes estimates of: 1) incident hospital admissions associated with a primary (ICD-9 codes: 428x, 402.01, 402.11, 402.91, 404.1, 404.3, 425x, 518.4, 514, 391.8, and 398.91, and ICD-10 codes: I50x, I11.0, I13.0, I13.2, I42x, J81, I01.8, I02.0) or secondary (with a principal diagnosis of a cardiovascular

Table 1 Datasets – purpose and references

Datasets	Purpose	Reference
Population profile		
- Australian Demographics Statistics 2014	To obtain data representing the Australian population by sex and age as calculated on 30 June 2014	ABS [10]
Incident cases		
- Incidence and aetiology of heart failure; a population-based study	To determine the population incidence of heart failure data by sex and age groups	Cowie et al. [15]
- Quantifying the heart failure epidemic: prevalence, incidence rate, lifetime risk and prognosis of heart failure: The Rotterdam Study		Bleumink et al. [16]
Prevalent cases		
- Congestive heart failure in the community a study of all incident cases in Olmsted County, Minnesota in 1991	To determine the population prevalence of heart failure data by sex and age groups	Senni et al. [17]
- Prevalence of heart failure and systolic ventricular dysfunction in older Australians: the Canberra Heart Study		Abhayaratna et al. [8]
- Quantifying the heart failure epidemic: prevalence, incidence rate, lifetime risk and prognosis of HF: The Rotterdam Study		Bleumink et al. [16]
Hospital activity		
- Heart Failure Incidence, Case Fatality, and Hospitalisation Rates in Western Australia Between 1990 and 2005	To evaluate the hospital burden of heart failure	Teng et al. [9]
Cost and burden of HF		
- Pressure points in primary care: blood pressure and management of hypertension in 532,050 patients from 2005 to 2010	To investigate the primary care burden of heart failure	Carrington et al. [4]
- Impact of Home Versus Clinic-Based Management of Chronic Heart failure The WHICH? Multicenter, Randomized Trial	To calculate the financial burden of heart failure	Stewart et al. [18]
Future projection		
- Population Projections, Australia, 2012 (base) to 2101	To calculate the projection data to 2030	ABS [11]

condition such as ischemic heart disease or atrial fibrillation, but not acute myocardial infarction) diagnosis of composite HF, 2) type of admission (unplanned or planned), 3) length of hospital stay (LOS), 4) in-patient case-fatality, 5) discharge destinations (i.e. own home, acute hospital or long-term rehabilitation or residential/supported care), 6) readmissions within 12 months and 7) any hospital admissions (*new/de novo* or recurrent event) associated with a primary or secondary diagnosis of HF overall and LOS per annum.

Health care costs

Estimations of the annual cost of managing those individuals hospitalised with HF including the cost of their in-patient care (including *per diem* hospital costs) and auxiliary device therapy plus associated community management costs were based on a recently published HF-specific management trial detailing all health care costs typically associated with the management/care of patients presented with a composite diagnosis of HF within Australia [18]. These were applied to prevalent cases of

HF (but not additional cases of HFpEF alone). Specifically, community management costs including allied health professionals and health services respective unit cost (\$1825 per year) was multiplied by all HFpEF cases with an adjustment for days alive and out-of-hospital (99.4 %). All HF-related hospital episodes were multiplied by the average cost of hospital stay (\$1806 per day).

Future burden

The estimated future trend and growth rate in incidence and prevalence of HF (once again predominantly that associated with HFpEF) was projected to 2030 using the latest population projection data (released in 2013) that included a moderate assumption on future fertility and mortality rates and a constant net migration [11]. Conservatively, we assumed that the incident and prevalent cases of HF would remain stable from 2014 to 2030 and the same occurrence statistics were applied to an increasingly ageing Australian population to form the projection data.

Population prevalence of HFpEF

In order to estimate the additional contribution of those individuals with HFpEF alone (with clear expectations of older, more female cases with a history of hypertension), we applied international HFpEF prevalence statistics [17] according to age and sex, to the Australian population by 10-year age groups to calculate the point prevalence of HFpEF as at June 2014.

Results

Incident cases

Annually, we estimate that over 61,000 (or 6.9 per 1000 person-years) Australians aged ≥ 45 years (58 % women) are diagnosed with HF (Fig. 1). The incidence rate is higher in men (0.3 per 1000 person-years) aged 45 to 54 years when compared to women of the same age range (0.1 per 1000 person-years), with a relatively similar upward pattern for both sexes aged 55 to 74 years. However, in the older groups, the incidence rate increases exponentially in both men and women. Greater female longevity translates into women have higher incidence rates (29.2 per 1000 person-years) in those aged ≥ 75 years (Table 2).

Prevalent cases

Overall, we estimated that, on an annual basis, approximately 480,000 Australians (66 % men) are affected by HF predominantly associated with HFrEF. This equates to 6.3 % (95 % CI 2.6 to 10.0 %) of those aged ≥ 45 years or 2.1 % (2.8 % of men and 1.4 % of women) of the entire Australian population of 22 million people in 2014. As anticipated, Fig. 1 shows that most cases were from

the most populous States on the Eastern seaboard of Australia. New South Wales and the Northern Territory had the highest and lowest number of people affected by HFrEF overall with 158,593 (33 %) and 3118 (0.7 %) cases, respectively. Reflective of global patterns and the clinical paradigm of HF, the prevalence estimates are five times higher in men (77,171, 5.1 %) than in women (15,428, 1 %) aged 45 to 54 years and remain higher at each age-group from 55 to 74 years. However, there is a sharp increase in prevalent cases of HF in women aged ≥ 75 years (Table 2).

Hospital activity

There were an estimated 27,468 (45 % of all incident cases) new HF-related incident admissions in 2014, of which 60 % were admitted with a primary diagnosis of HF. Incident admissions increase steeply with advancing age, especially as a primary diagnosis in those aged ≥ 65 years. More than 80 % of all incident HF-related admissions were ‘unplanned’ and the total annual LOS associated with these admissions was approximately 225,000 days (average 8 days per admission). The majority of those who survive the index-event return to their own home post-discharge (79 %) and the remainder (increasing with age) receive ongoing management via another acute care facility or, due to general health deterioration, require ongoing residential care and support (21 %). This latter (and costly) phenomenon becomes increasingly more likely with each repetitive hospital admission.

The total number of readmissions within the 12-months following an incident hospitalisation for HF (of any

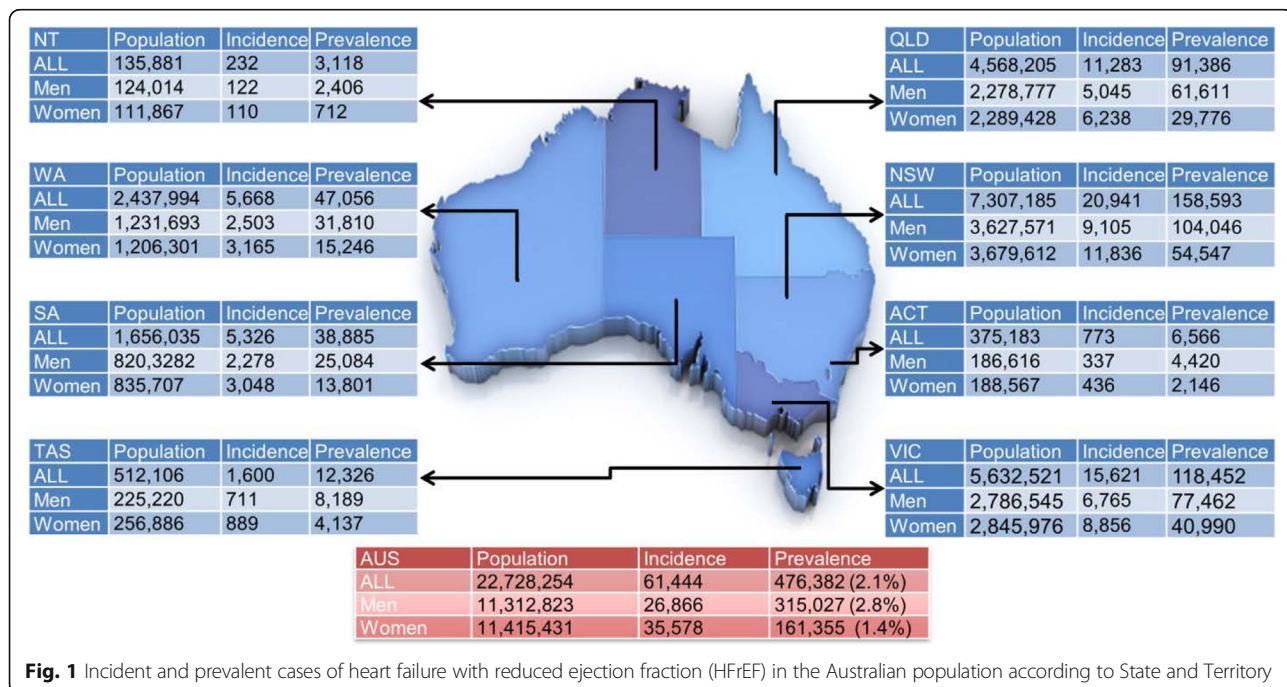


Fig. 1 Incident and prevalent cases of heart failure with reduced ejection fraction (HFrEF) in the Australian population according to State and Territory

Table 2 Australian adult population (aged ≥ 45 years) and estimated incident and prevalent cases of heart failure with reduced ejection fraction (HFrEF) and all hospital activity associated with a primary or secondary composite diagnosis of heart failure

Age (years)	Population	Incident cases ^a	Prevalent cases	Hospital admissions ^b (primary/secondary)	LOS ^g (days)
Men					
45–54	1,513,403	454 (0.3) ^c	77,171 (5.1 %) ^e	18,732 (123.8) ^g	114,298
55–64	1,283,890	2,831 (2.2) ^d	94,992 (7.4 %) ^e	15,747 (122.7) ^g	95,191
65–74	879,090	7,085 (8.1) ^d	56,376 (6.4 %) ^f	16,802 (191.1) ^g	113,030
75+	606,842	16,498 (27.2) ^d	86,488 (14.3 %) ^f	21,363 (352.0) ^g	168,600
Total	4,283,225	26,867 (6.3)	315,027 (7.4 %)	72,644 (169.6)	491,119
Women					
45–54	1,543,002	154 (0.1) ^c	15,428 (1.0 %) ^e	18,680 (121.1) ^g	113,985
55–64	1,306,222	2,876 (2.2) ^d	28,734 (2.2 %) ^e	15,655 (119.8) ^g	94,687
65–74	899,957	7,281 (8.1) ^d	28,760 (3.2 %) ^f	14,783 (164.3) ^g	99,466
75+	832,122	24,268 (29.2) ^d	88,433 (10.6 %) ^f	25,576 (307.4) ^g	206,856
Total	4,581,303	34,580 (7.5)	161,355 (3.5 %)	74,703 (163.1)	514,994

LOS length of stay

^aCases per 1,000 person-year in the parentheses; ^badmissions rate per 10,000 person-year in the parentheses; primary or secondary composite diagnosis of heart failure Key statistics used for estimation ^cCowie et al., ^dBleumink et al., ^eSenni et al., ^fAbhayaratna et al., ^gTeng et al.

diagnosis) is estimated to be > 10,000 separations (37 % of all incident HF-related admissions). Reflective of an increasing clinical complexity, often with multimorbidity for those with the syndrome, the risk of readmission increases steeply with age especially among men aged up to 75 years (750 separations per 5-year age group) and women aged ≥ 85 years (1800 separations).

Overall, we estimated that HF contributes to > 147,000 hospital admissions (rate of 166.2 per 10,000 population). This comprises 45,000 separations (50.6 per 10,000 population) as a primary diagnosis and 102,000 separations (115.6 per 10,000 population) as a secondary diagnosis. This results in > 1 million days in hospital each year. Of these, the greatest burden of this debilitating condition is in hospital stay among persons aged ≥ 65 years (58 % or 587,952 days with a mean LOS of 7.5 days) compared to

those aged < 65 years (42 % or 418,161 days with a mean LOS of 6.1 days; Table 2).

Costs

Based on the number of prevalent cases of HF (predominantly those with HFrEF), we estimated that the annual community management cost is approximately \$867 million and nearly \$2.68 billion per annum (\$1.46 billion for men versus \$1.22 billion for women) when considering the additional cost of in-patient care (\$1.82 billion or 68 % of total expenditure) associated with all HF-related hospital admissions. Overall, the cost of in-patient care is twice as high as community care, and in women only the ratio is three times as high (Fig. 2) with readmissions constituting a substantial proportion of all hospitalisation costs.

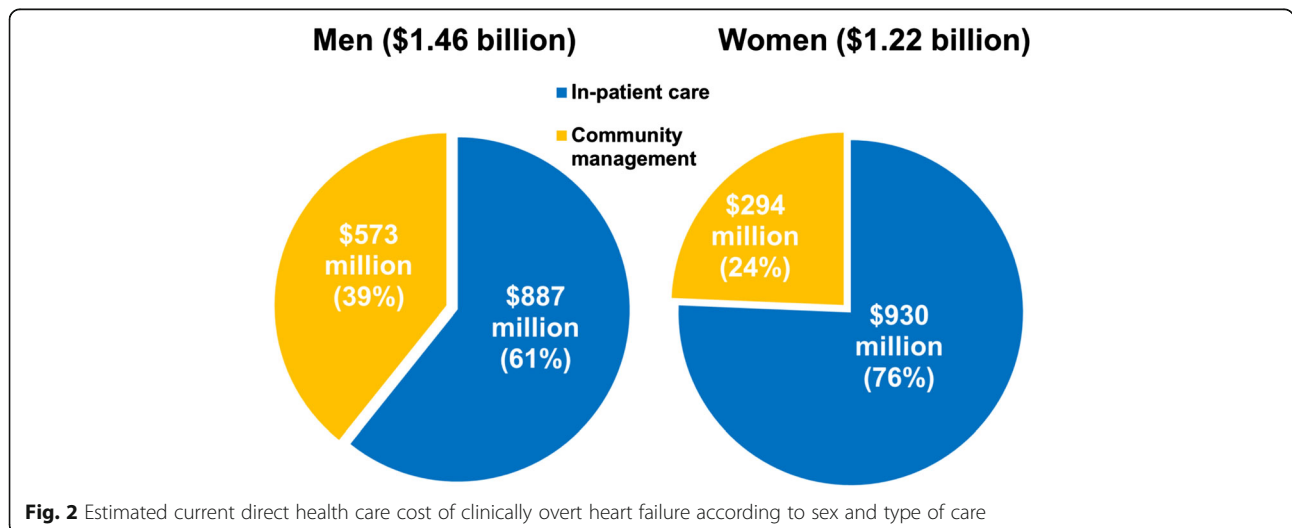


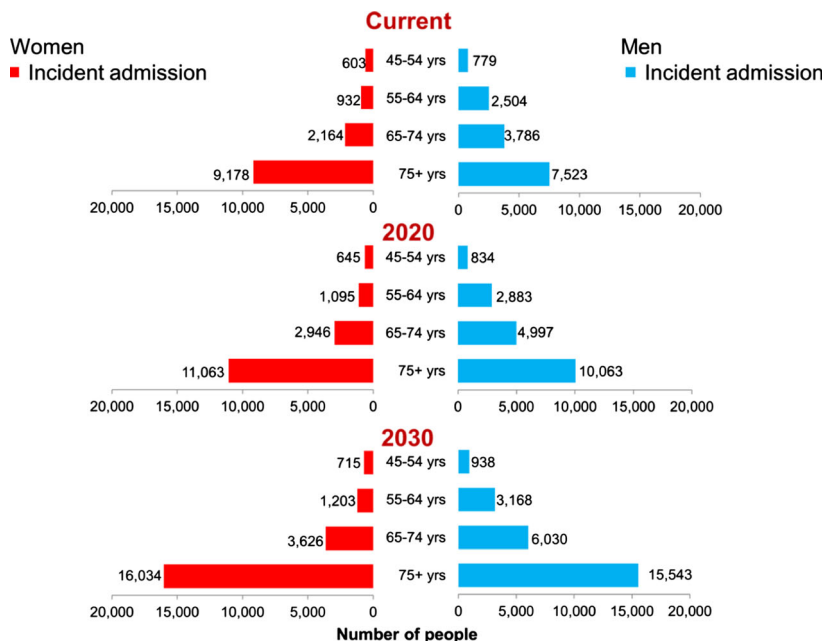
Fig. 2 Estimated current direct health care cost of clinically overt heart failure according to sex and type of care

Future burden

Based on a conservative assumption that incident and prevalent cases of HF (once again predominantly that relating to HF_rEF) would remain stable from 2014 to 2030, we predict that the annual number of HF-related

incident admissions will continue to rise to nearly 35,000 (in 2020) and to more than 47,000 by 2030 (Fig. 3). As expected, the projected increase in incident admissions in persons aged ≥ 75 years is significantly greater than in those aged ≤ 65 years (89 % versus 31 %). Consequently,

a Incident heart failure-related admission



b Prevalent cases of heart failure with reduced ejection fraction (HF_rEF)

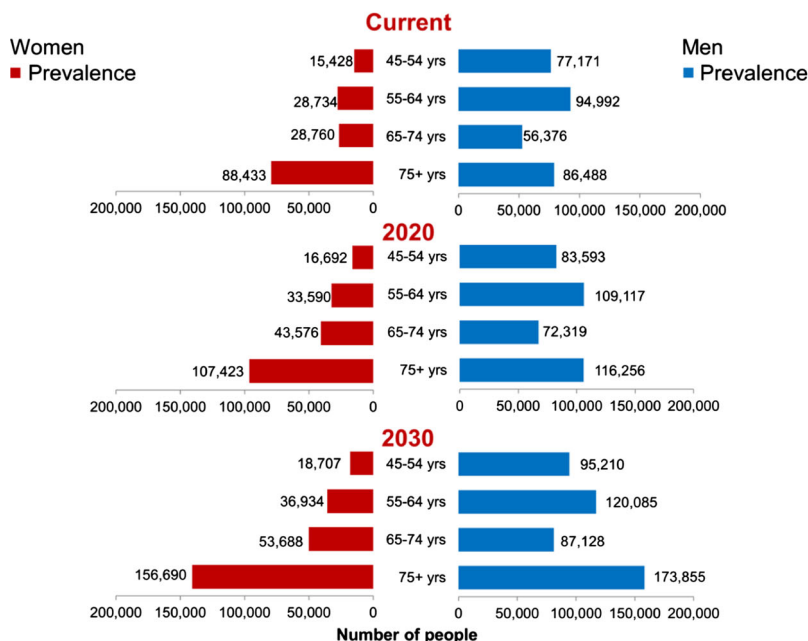


Fig. 3 Current and projected estimations of **a** incident heart failure-related admissions and **b** overall prevalent cases of heart failure with reduced ejection fraction (HF_rEF) from 2014 to 2030 according to sex and age categories

we estimate that by 2020, there will be a minimum prevalent population of approximately 580,000 cases of HF (an increase of 21 % in men and 25 % in women) and as many as 750,000 Australians will be affected by this debilitating syndrome in 2030 (an increase in prevalence of 51 % in men and 65 % in women from 2014). Taken together, this represents a significant increase in an ageing and rapidly expanding Australian population even without any changes to incidence or survival rates. We also predict that the prevalence gap between men and women will continue and perhaps widen over time, potentially due to the increase in the number of older women affected by the syndrome.

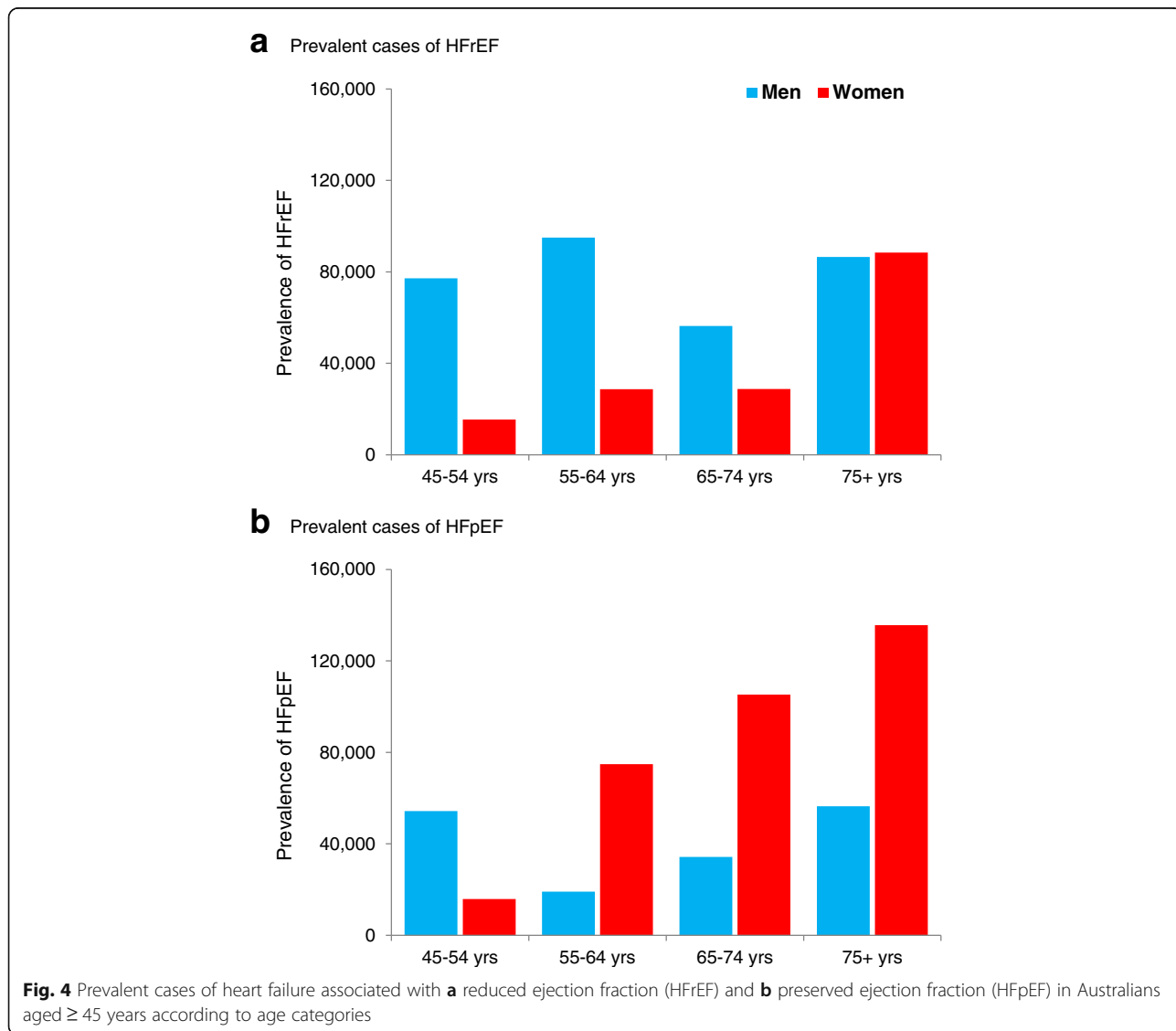
Additional population prevalence of HFpEF

We estimated that an additional 496,000 Australians (67 % women) aged ≥ 45 years (6.6 %, 95 % CI 2.1 % to 11.1 %)

are affected by HFpEF alone each year. In contrast to the age and sex distribution of HFrEF, more women (331,670) than men (164,182) were likely to be affected by HFpEF. With the exception of those in the younger age group (45 to 54 years) where there were three times more men (54,331) than women (15,893), there were significantly more women than men with HFpEF in successively older age groups (Fig. 4).

Discussion

Despite wide recognition of an evolving burden of HF globally, there is a lack of high-quality clinical/epidemiological data to quantify the number of Australians affected by this deadly syndrome. Using contemporary population data and conservative estimates derived from robust Australian and international studies, we estimate that approximately 61,000 new cases of clinically overt HF are diagnosed



yearly, with a prevalence approaching 480,000 and around 150,000 hospital admissions associated this syndrome overall. Collectively, patients with a composite diagnosis (either as primary or secondary) of HF probably contribute to over 1 million days in hospital at a cost of more than \$2.6 billion (largely due to recurrent hospital care/episodes). We also predict that, without a substantial change in the drivers of the syndrome, prevalence of HF predominantly associated with HF_rEF will continue to grow over the next 10–15 years to nearly 750,000 people with an annual managing cost in excess of \$3.8 billion by 2030. These figures do not reflect the likely additional burden (predominantly affecting older women with non-ischaemic aetiology) of close to 500,000 Australians with HF_pEF alone. This latter component of the HF burden remains most challenging both in terms of diagnosis and treatment [19]. However, it cannot be ignored given the ageing Australian population, even if, as some would argue, it represents a more benign condition within the spectrum of the HF syndrome [20].

Comparison between current and previous estimates

Since our first report on the ‘hidden epidemic of HF’ published 11 years ago [2], there has been a steady decrease in coronary artery disease mortality [21] potentially due to improved medical and therapeutic management. Although the risk of experiencing a further cardiac event is not universal and varies considerably across the spectrum of survivors, it seems probable that the success in treating these cardiac conditions will increase HF prevalence now that these patients survive and live longer with multimorbidity [22]. Our prior estimates of around 325,000 Australians living with HF, 22,000 new HF cases diagnosed and 100,000 HF-related hospitalisations in 2000 [2] is in synergy with the current estimates of 480,000 Australians with HF, 27,000 incident HF-related admissions and 147,000 hospitalisations overall, an increase of 47 %, 23 % and 47 %, respectively, from over a decade ago. As such, the current estimates support our prior conclusion of a ‘HF epidemic’ in Australia and demonstrate an upward trend over time with no sign of slowing down. These data are at odds with official estimates of around 280,000 HF cases in Australia (population prevalence 1.3 %). However, such data are almost a decade old and critically flawed by the fact that they were derived by a self-reported diagnosis of HF and/or presence of peripheral oedema [23]. In addition, we found a higher prevalence of HF specifically related to HF_rEF in men than in women and an exponential trajectory in the older age groups illustrating the key influence of progressive population ageing. Our data are also consistent with European, North American and Asian studies [13, 24, 25] in exploring the size of the HF burden and its consequent health and economic impacts due to high readmission

rates and long durations of hospital stay, particularly in the very elderly. However, focussing on HF_rEF cases alone belies the substantive contribution of HF_pEF to the current and future burden of HF in Australia and beyond; particularly when one considers that most clinical studies would suggest HF predominantly affects men but epidemiological studies suggest a more even gender balance [26].

Public health implications

HF has become a burgeoning public health problem reaching epidemic levels especially for the older age population. Currently, our estimate of half a million Australians living with HF predominantly associated with HF_rEF costs the Australian health care system billions of dollars every year as well as the broader economic/societal impact on our community, family and on an individual's quality of life. Despite this, HF remains a poorly recognised and under-appreciated burden in Australia, and the Australian health care system remains ill-prepared to detect, prevent and manage this disabling and costly syndrome; particularly in delineating between cases of HF_rEF and HF_pEF and diagnosing the latter in older women (see below). Our projections demonstrate a pronounced increase in clinically overt HF cases especially for the older populations in the coming decades coupled with escalating social, health and economic implications if no changes are made.

At the same time, the definition of HF_pEF has evolved and is increasingly recognised as a significant public health problem worldwide [20, 27]. However, due to the lack of Australian-specific data and potential disparities in standardised HF_pEF diagnosis between different studies [5], an accurate assessment is difficult to make compared with equivalent HF_rEF estimations. Individuals with HF_pEF tend to be older at the time of initial diagnosis and most have a history of hypertension and/or atrial fibrillation [26, 28]. In regards to frequency in the population, we believe that HF_pEF may be as prevalent as HF_rEF and we estimate that women outnumber men by a 2:1 ratio and its overall prevalence among all persons with HF (HF_rEF and HF_pEF) was 43 % in those aged < 65 years and 56 % in those aged ≥ 65 years. Hence, it is likely that the overall mortality rate attributable to HF_pEF is higher than HF_rEF given the higher proportion of HF_pEF in the older population.

Despite many efforts in improving quality of life and survival, HF has a poor prognosis with 12 % mortality within 30 days following an incident admission and cumulative mortality of approximately 31 % and 50 % at 1-year and 5-years, respectively. This is worse than the prognosis for most cancers [29]. It is prudent that there is an increasing focus on HF prevention rather than spending more money on expensive and less effective treatments for the syndrome. For high-risk individuals including those with hypertension, diabetes, chronic kidney

disease, coronary artery disease and vascular disease, renewed efforts to prevent progressive cardiac dysfunction should be the focus of research efforts and preventative health care programs. In addition, the application and optimisation of proven strategies for HF management such as 'gold-standard' therapeutics [30], devices [31], tele-monitoring [32] and nurse-led multidisciplinary programs of care [33] can cost-effectively improve outcomes in HF. More efforts are also needed to gain better insight into the drivers of HF hospitalisations (often costly and prolonged) and preventable (repeated) readmissions that are imperative for improving individual care and addressing broader economic resource implications.

Limitations

A number of specific limitations need to be reinforced in relation to the estimates derived from this study. Firstly, there is still a paucity of local data to accurately quantify the incident to prevalent cases of HF in Australia. Therefore, large-scale, population-based studies are required to ascertain the true burden of HF from a number of perspectives including health care utilisation, economic (direct and indirect) costs and its broader societal impact. Secondly, increasing disease awareness (including the introduction of broad screening programs), and the continuous rise in the ageing population will increase the annual incidence of HF. Thus, future projections must be interpreted with some caution, given that certain factors may negatively or positively affect HF incidence and survival rates (fundamental drivers of prevalence). After careful consideration we have not included formal sensitivity analyses (over and above providing confidence intervals for key estimates and considering key population variables in deriving future projections of HF) as per original report given the greater availability of Australian-specific data and our consideration of the additional burden imposed by HFpEF. Thirdly, the current impact of antecedents and comorbidities of HF including coronary heart disease and hypertension and the prevalence of cardiovascular disease risk factors such as diabetes, tobacco smoking, excess alcohol, obesity and physical inactivity will remain influential. These may also change over time owing to increasing prevalence or improved therapies and management. Consequently, our projections may potentially under- or over-estimate prevalence, depending on the factors considered. Finally, other confounding factors such as socioeconomic status, access to primary health and acute care services, admission thresholds for HF and climatic factors are also likely to impact on the precise estimation/prediction of the magnitude and implications of the HF burden.

Conclusions

In summary, our report uses the latest national and international clinical and epidemiological data to generate a

contemporary snapshot of the current and potential future impact of clinically overt HF in Australia. They support the expectation that HF will continue to impose a significant burden both locally and globally in the coming decades. Without a dramatic change, older and sicker Australians will develop this deadly and disabling syndrome. In response, we need clear preventative strategies to target the antecedent risk factors and broader determinants to address the complex causes of HF. In addition, we need more systematic applications that integrate cost-effective management and treatment. HF, whether it be described within the confines of HFrEF or broadened to include cases of HFpEF is an enormous detrimental public health problem now and for the foreseeable future.

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Availability of data and materials

A comprehensive report on the contemporary burden and profile of heart failure in Australia can be found at: http://mmihr.acu.edu.au/wp-content/uploads/sites/2/2015/08/v4-Reduced-Rediscovering-Heart-Failure-Burden_Report-August-2015-2.pdf.

Authors' contributions

SS and MJC were involved in the development of study design. YKC and SS were involved in the systematic review of literatures and data acquisition and analyses. YKC drafted the manuscript. All authors have assisted in interpreting the results, reviewing and approving of the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Not applicable.

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