



*Research article*

## How Modelling could Contribute to Reforming Primary Care— Tweaking “the Ecology of Medical Care” in Australia

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**Abstract: Background:** The *Australian Ecology of Medical Care* indicates that 255/1,000 Australians consult a GP 1.8 times/month (466 consultations/month) resulting in 42 specialist, 1.4 ED and 1.9 hospital referrals, 478 prescriptions, 220 pathology and 48 radiology tests, costing the Government \$ 72,009 (2012–13). Government believes this to be unsustainable and controllable by setting price signals. **Objectives:** To investigate the impact of ‘small changes’ to health service utilisation and/or resource use. **Method:** Modelling the impact of increases and decreases to healthcare utilisation/resource use over a 5-year period. **Results:** Strategies targeting only one variable had a small and linear impact on healthcare expenditure ( $\pm 0.6$ –7.2%); combining changes had an exponential effect, achieving an up to 15% reduction or an over 20% rise in expenditure. **Discussion:** Change invariably results in trade-offs; modelling is a tool that can provide a basis to engage in shared discussions about the ‘yes, but/yes, and’ considerations of reform propositions.

**Keywords:** ecology of medical care; modelling; primary care reform; leadership; complex adaptive systems

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*“You can’t impose anything on anyone and expect them to be committed to it.”*

*(Edgar Schein, MIT Sloan School)*

## 1. Introduction

Whilst primary care has long been regarded as the mainstay of the healthcare system, successive governments (not only in Australia) also regard it as a problem—too many people use general practice, escalating healthcare costs and thus threatening the sustainability of the Medicare system\* [1]. This view supposes that managing healthcare is an economic problem; hence it can be solved by economic strategies like introducing price signals [2]. While this solution may appear obvious to economically driven administrators and policy makers it fails to resonate with patients and the medical profession; indeed, concerted public and professional opposition has stopped this policy approach for now [3].

Polarised perspectives usually indicate a lack of engagement and consensus, a failure frequently observed when confronted with wicked problems. Wicked problems are defined as those that are difficult or impossible to solve as there are firstly insufficient and/or contradictory data, secondly desired outcomes shift and thirdly underlying assumptions often remain unrecognised [4]. The various aspects of a wicked problem have interdependent relationships which result in solutions uncovering and/or creating new problems [5]. Table 1 highlights some of the issues affecting healthcare reform from a primary care perspective (Table 1).

**Table 1. Understanding the diverse issues that impact the understanding of the need for healthcare reform.**

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**The defining issues of the health reform mess—adapted from Horn’s definition (4)**

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- No unique “correct” view of the problem
    - Too many people consult a GP
    - People consult unnecessarily for trivial problems
    - GPs fail to deal with problems comprehensively and collaboratively
    - Costs are driven by over-investigating/referring/prescribing
    - A problem caused by the ageing of the population and the associated rise in chronic disease
  - Doctors practice defensive medicine
  - Social dimensions of disease are neglected
  - “Sausage machine” practice
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- Different views of the problem and contradictory solutions
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\* Medicare is the government run health insurances system, to a small degree funded by a levy on income tax, the rest from consolidated revenue.

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- Simple problems can be delegated to lower level health professionals making healthcare more cost effective
  - GPs deal with multiple problems in the same consultation resulting in increased comprehensiveness, effectiveness and efficiency
  - Specialists provide better disease specific care compared to GPs, however there is no difference in morbidity outcomes though a marked increase in cost
  - If cost is the problem, cost control measures will change utilisation and use of healthcare resources
  
  - Most problems are connected to other problems
    - Social determinants of health
    - Environmental exposures
    - Technological advances in medicine
  
  - Data are often uncertain or missing
    - Administrative data are based on billing records
    - Clinical data are scarce and collected unsystematically
    - Uncertainty about which data truly indicate quality of care
  
  - Multiple value conflicts
    - Providers—vested income in fee-for-service environment
    - Medical supply enterprises—sales and profits
    - People—“me first” attitudes
    - Funders—limited resources
    - Medical corporations—profit before care
  
  - Ideological and cultural constraints
    - Contested ideas of health and citizen rights
  
  - Political constraints
    - Party politics
    - Health professional organisations’ politics
    - Health advocacy groups
    - Supply chain lobbies
  
  - Economic constraints
    - Public healthcare budgets
    - Private health insurance
    - Out-of-pocket expenses
  
  - Numerous possible intervention points
    - Population behaviour change
    - Individual behaviour change
    - GP behaviour change
    - Changing medico-legal rules
    - Focusing healthcare policy on “independent coping with disease”
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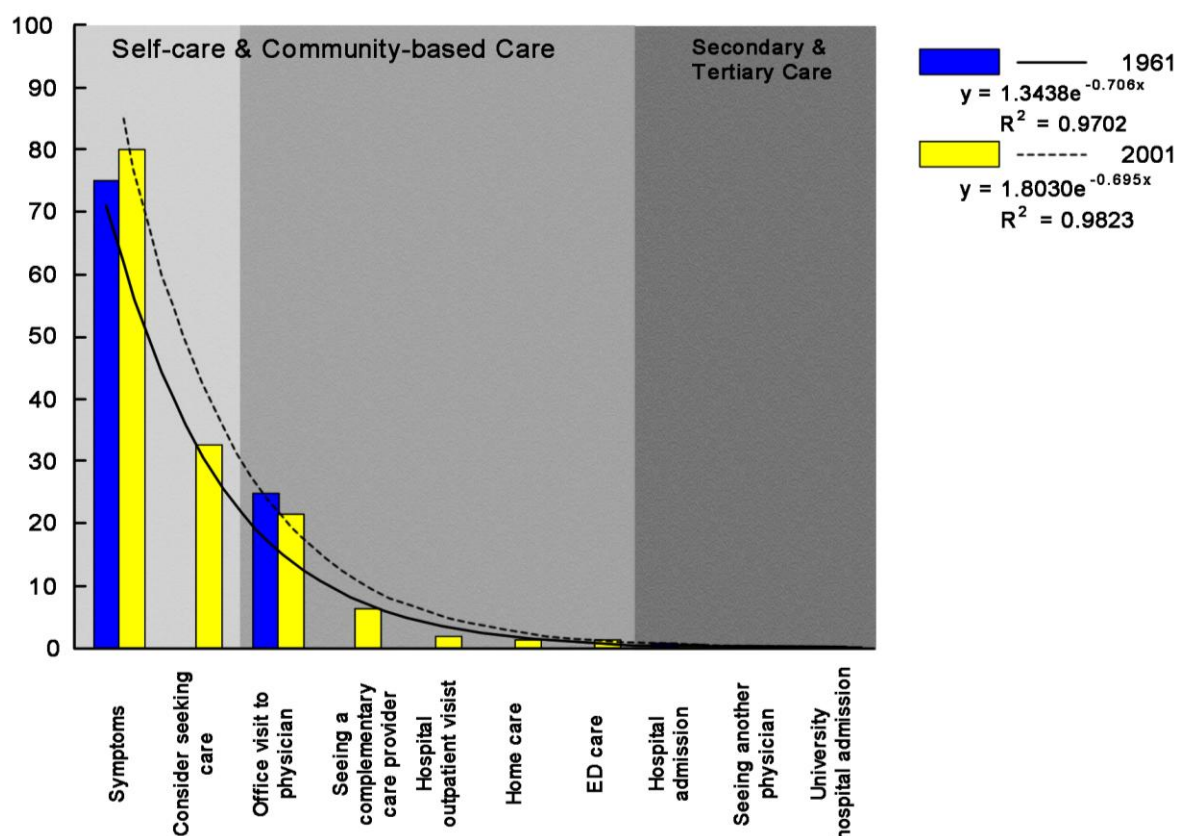
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- Aim at “customised care” in light of individual aspirations
  - Consequences difficult to imagine
    - Long-term impacts
    - Considering change in other domains outside health care, like employment rates, better public transport, working from home
    - Reinvesting savings in healthcare to build social capital, e.g. housing, education, recreational infrastructure like walkways, bikeways and parks
    - Enjoying life despite chronic disease and disability
  - Considerable uncertainty, ambiguity
    - Behaviour change is not predictable
    - Group effects on behaviour
    - RCTs provide average effect data, information unpredictable for individual outcome
  - Great resistance to change
    - Entrenched ideological positions and interests
    - Unrealistic expectations on health care
  - Problem solver(s) out of contact with the problems and potential solutions
    - Bureaucrats approach problem based on political objectives and fail to understand patient and practitioner needs and constraints
    - Politicians provide inconsistent views depending on their audience
    - Patients regard their personal issues as the ones most pressing and underappreciate the impact on the rest of the community
    - Health professionals aim to act in the best interests of the patient in front of them without necessarily considering the resource implications for the rest of the community
    - Health professionals prioritise problems from their professional view and tend to underappreciate the person’s ability to cope and function
    - Hospital based practitioners don’t understand community practitioners’ working conditions
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One approach to better handle wicked problems is modelling; models display the various components of a problem and highlight their relationships. Modelling is a process that allows all interested stakeholders to engage with an issue, achieve a deeper understanding of its multiple facets and contribute collaboratively to finding the best possible and workable solution within contextual constraints [6].

## 2. The Healthcare Context

In 1961 Kerr White and colleagues [7] published their landmark paper *The Ecology of Medical Care* demonstrating that most people are healthy most of the time. Their study also revealed that people mostly self-care and seek out medical advice only as ‘a last resort’. Based on US-figures,

community illness experience has remained remarkably stable over time [8,9]; however, rising illness anxieties have resulted in a significant rise in healthcare seeking. Surprisingly medical practitioner care has remained relatively stable, the additional demand being largely met by ‘alternative practitioners’ [8]. Illness experience and health services utilisation continues to follow a power law distribution (the 80/20 split)—in short 16% of the community require primary, 3.2% secondary specialist and 0.8% tertiary hospital care (Figure 1) [10]. How changes to illness experience and health service use might impact on health system sustainability has become a critical question that can be explored and critically evaluated through collaborative modelling exercises.



**Figure 1. The Pareto-distribution of medical care—1961 and 2001, Note: further analysis from 2012 show no changes in overall utilisation of health services [9].**

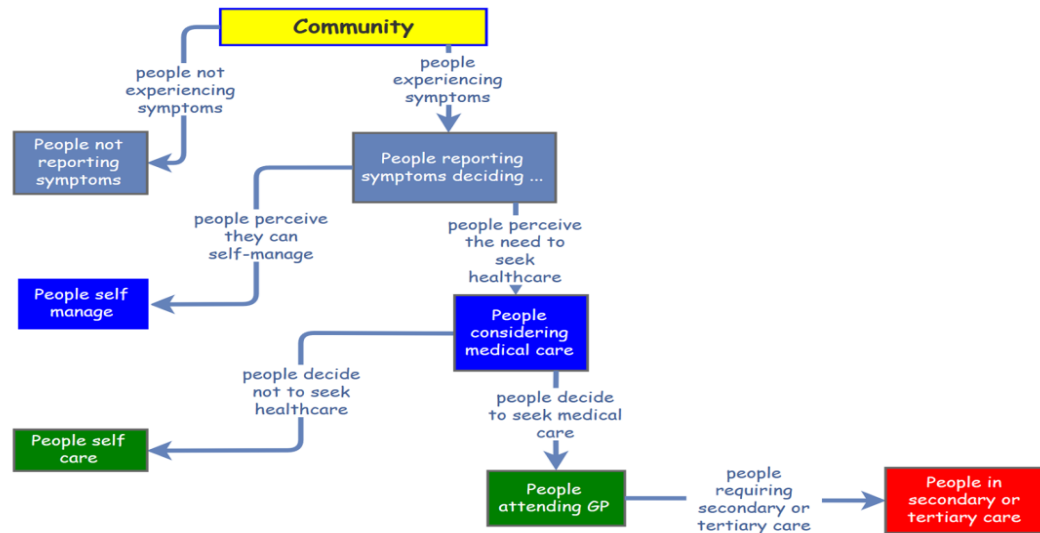
### 3. The Ecology of Medical Care in Australia

Given our local (Australian) background we first had to develop an *Australian Ecology of Medical Care* model<sup>†</sup> based on available data from various sources [11–15] (Figure 2). Assuming a stable health seeking rate in the community as previously demonstrated [7,8] we estimated that 640 out of a 1,000 Australians/month ‘experience some kind of illnesses. Medicare and BEACH data

<sup>†</sup> <https://insightmaker.com/insight/27388/Clone-5-The-Ecology-of-Medical-Care>

(2012–13) [11] allowed the calculation of healthcare utilisation—per month 320 out of 1,000 Australians ‘perceive the need to seek healthcare’, 255 ‘consult a GP’, visiting 1.8 times/month resulting in 466 unique consultations. These consultations generate 42 specialist referrals, 1.4 ED referrals, 1.9 hospital admissions, 478 prescriptions, 220 pathology and 48 radiology tests [11].

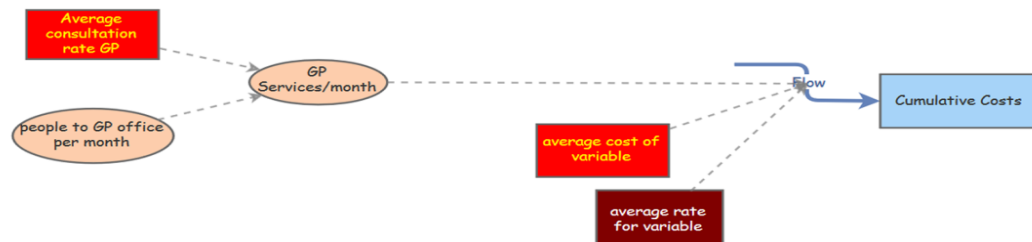
### "The Ecology of Medical Care" Flow of people according to symptoms and perceived need



### Cumulative Service Calculation



### Cumulative Cost Calculation



**Figure 2. The Ecology of Medical Care in Australia.** The flowchart shows the decisions people in the community take at each level of perceived care need (top). Only people

attending a GP contribute to cumulating number of services and costs (middle and bottom).

(<https://insightmaker.com/insight/27388/Clone-5-The-Ecology-of-Medical-Care>)

GP-related services/1,000 Australians consume \$ 72,009/month—\$ 21,310 on GP consultations (ave \$ 45.73/person), \$ 3,331 on specialist consultations<sup>‡</sup> (ave \$ 78.37/person), \$ 1,481 on ED-visits (ave \$ 1,058.15/person), \$ 11,279 on hospital stays (ave \$ 5,963.30/person), \$ 24,218 on medications (ave \$ 51.97/person), \$ 4,326 on pathology (ave \$ 19.71/person), \$ 6,064 on radiology (ave \$ 126.33/person) [12–15] (Appendix 1 details the data sources).

#### 4. Modelling the Australian Ecology of Primary Care

‘Perceived healthcare needs’ in the community, ‘primary care utilisation’ and ‘primary care service delivery’ as well as ‘resource use in the consultation’ determine healthcare costs. We considered the effect of changes to each of these variables, individually and in combination on two scenarios, an ongoing ‘silent’ increase and an ‘incentivised’ decrease in healthcare utilisation and resource use over a 5-year period compared to the status quo.

In interrelated models, ‘small changes’ often result in nonlinear change, i.e. small changes can result in large outcomes whereas large changes may result in no outcomes. We deemed a ‘small change’ in the yearly rates of ‘perceived healthcare need’, ‘attendance rate’ and ‘overall number of GP consultations’ to be  $\pm 5$  and  $\pm 10$ . ‘Small change’ in GP resource use per 100 consultations was assumed to be  $\pm 0.1$  and  $\pm 0.2$  for specialist referrals,  $\pm 0.5$  and  $\pm 1.0$  for prescribing and  $\pm 0.2$  and  $\pm 0.4$  for pathology and radiology ordering per year.

#### 5. Modelling Assumptions and Rationale

Six change strategies and possible implementation strategies were considered and their impacts modelled for both levels of change and direction in each of the 4 postulated changes.

##### 5.1. Strategy 1—changing perceived need for health care

Health care is initiated by the person’s perception of feeling or being ill. Not all of these perceptions are based on real illness or persist for long enough to actually initiate a consultation. As perceptions are in constant flux they can be influenced—population based advertising can focus on enhanced self-care or greater disease vigilance, policy implementation can enhance or decrease social determinants of health and social capital.

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<sup>‡</sup> Excludes office procedures

5.2. *Strategy 2—changing primary care utilisation, the patient’s decision to attend a GP*

Primary care utilisation is in part dependent on patients’ perceived need to see a doctor as it is on GP accessibility. Part of controlling utilisation is dependent on patient education during the consultation.

5.3. *Strategy 3—changing primary care utilisation, the average consultation rate/month*

Again, patients and doctors can promote utilisation behaviours, and vested interest can interfere in decision making.

5.4. *Strategy 4—simultaneously changing the communities’ perceived need for health care, the patient’s decision to attend a GP and the number of GP consultations/month*

Combining strategies that influence health seeking, actual consulting and frequency of consulting have interdependent multiplicative effects resulting in nonlinear outcomes. This strategy would depend on changes of public awareness and educational strategies for the community and general practitioners as well as changes to the general practice remuneration system.

5.5. *Strategy 5—simultaneously changing community perceived need for health care, the patient’s decision to attend a GP and the number of GP consultations AND GP resource use relating to referring, prescribing and pathology and radiology ordering*

The more different strategies are employed simultaneously the greater the effects.

5.6. *Strategy 6—changing only GP resource use relating to prescribing and pathology and radiology ordering*

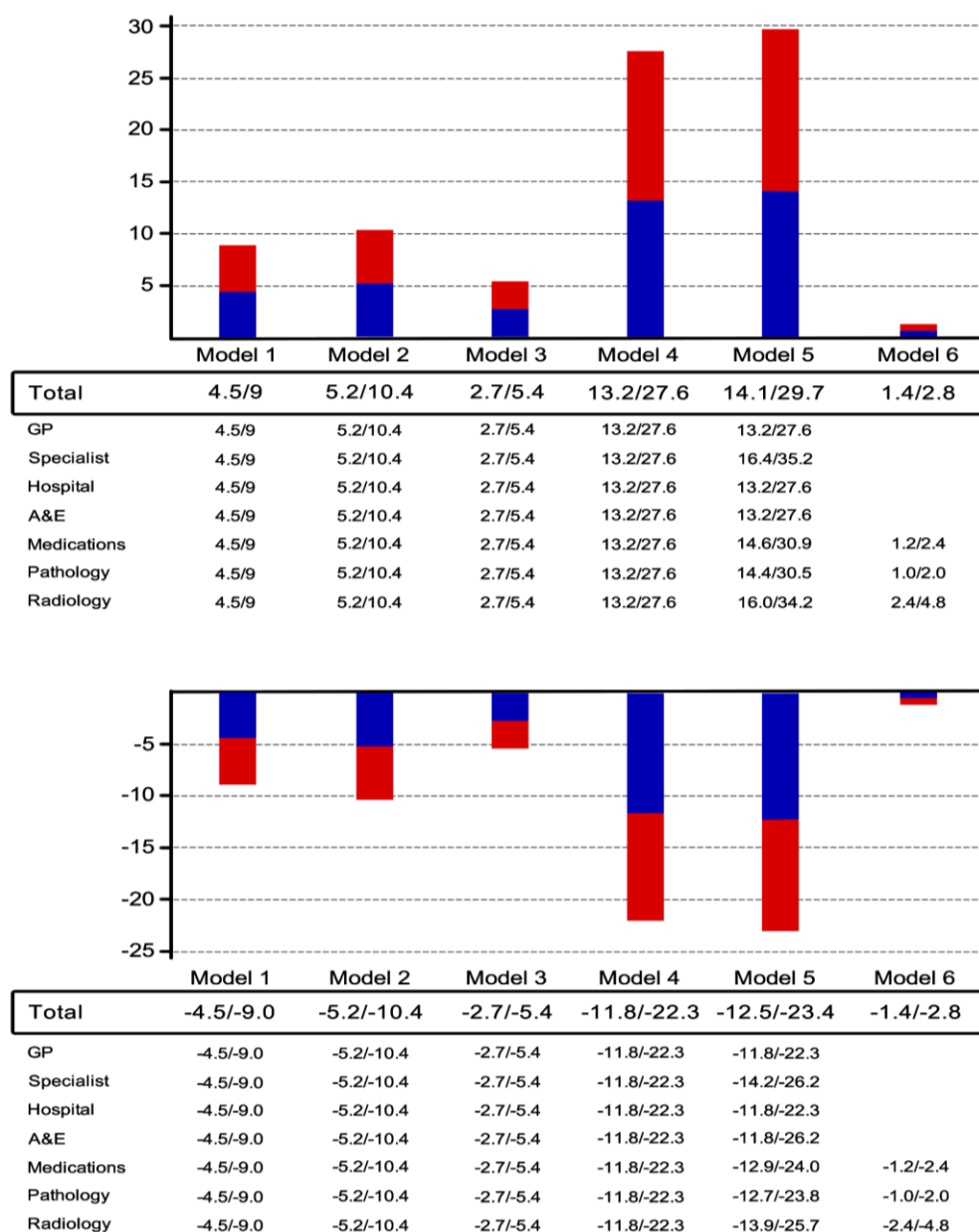
Continuing medical education focuses primarily on improving adherence to best clinical practice and focus on appropriate prescribing and investigating. The effectiveness of these strategies is usually marginal [16].

## 6. Outcomes

All strategies had some impact on healthcare expenditure (Figure 3, for a detailed breakdown of each strategy on GPs, specialists, emergency departments, hospitals, medication use, pathology and radiology see Appendix 2). Strategies targeting only one variable had a small and linear impact on healthcare expenditure ( $\pm 0.6$ – $7.2\%$ ), whereas combining changes, due to their reinforcing effects, had an exponential effect, achieving an up to 15% reduction or an over 20% rise in expenditure



(Strategies 4 and 5). Reinforcing effects result in nonlinear change, the reduced utilisation shows a slower reduction over time as fewer patients will seek healthcare and utilise referral services, however higher utilisation will result in a greater growth of expenditure as more people will seek care and utilise more referral services.



**Figure 3. The economic impact of the 6 change strategies.** For each of the 2 decreased (models 1 and 2) and 2 increased (models 3 and 4) scenarios (blue columns show the outcomes of the smaller, red columns those for the larger change assumptions). The bars show the percentage cost increase and savings. Columns present the changes of Strategies 1 to 6. Note the nonlinear change when combined strategies are used (4<sup>th</sup> and 5<sup>th</sup> columns).

## 7. ‘Yes, but/Yes, and’—Implications from a Primary Care Perspective

The *Australian Ecology of Medical Care Model* was built on best available data of the community’s perception of health and illness, and how individuals make decisions about the use of healthcare services. Modelling offers the opportunity to change data based on goal assumptions (e.g. we want to save x-amount of dollars) or estimates of potentially achievable changes in specific model variables (e.g. we think that education/incentives/patient expectations could reduce the average prescribing rate by x) in a safe environment—there are no mistakes to be made, model outputs merely offer a means on reflecting on potential interventions. Put differently modelling cannot provide unequivocal answers to the problems facing primary care; however, it offers important insights to inform the reform agendas [17]. Some of the important issues include:

- Uncontrolled growth in primary care utilisation can only lead to an unsustainable rise in healthcare expenditure, **and** ultimately will force cost containment measures.
- Reduced primary care utilisation and resource use would achieve expenditure reductions, **but** GPs, specialists, pathologists, radiologists and the pharmaceutical enterprises would invariably respond in an adaptive fashion to income reductions (table 2 summarises the magnitude of changes in expenditure before taking adaptive responses into account).
- Higher patient co-payments—the Government’s preferred policy instrument—may achieved short term cost savings, **but** late presentations of serious conditions may result in poorer health outcomes, lower patient satisfaction and increased cost for otherwise avoidable complications and especially hospitalisations.

**Table 2. The economic impact of the combined approach of changing health seeking and resource use in general practice.**

	<b>Model 1</b>	<b>Model 2</b>	<b>Current</b>	<b>Model 3</b>	<b>Model 4</b>
GP remuneration	−\$285,463.65	−\$151,665.73	\$1,281,903.36	\$168,947.17	\$353,500.52
Specialist referrals	−\$51,238.63	−\$27,724.91	\$195,521.24	\$32,181.51	\$68,877.65
Hospital admissions	−\$148,900.54	−\$79,110.28	\$668,652.90	\$88,124.44	\$184,389.21
A&E admissions	−\$19,816.10	−\$10,528.21	\$88,986.18	\$11,727.85	\$24,539.03
Medications	−\$289,230.86	−\$155,001.54	\$205,915.62	\$176,145.75	\$372,749.65
Pathology	−\$61,834.51	−\$33,098.75	\$260,232.55	\$37,522.81	\$79,309.97
Radiology	−\$93,635.46	−\$50,557.40	\$364,752.10	\$58,409.67	\$124,700.36
<b>Total −/+</b>	<b>−\$950,119.75</b>	<b>−\$507,686.82</b>	<b>\$4,065,963.95</b>	<b>\$573,059.20</b>	<b>\$1,208,066.39</b>

Note: Models 1 and 2 show the outcomes of the 2 savings strategies, Models 3 and 4 show the impact of the 2 growth scenarios. These impacts will determine adaptive strategies of stakeholders aimed to at least maintain the status quo.

Primary care reform aims to decrease costs without compromising health outcomes. To achieve these goals, all providers would have to accept decreasing service utilization and reduced resource use. This would have diverse implications, limited here to some remuneration and quality of care issues, including:

- Decreased service utilisation within the prevailing fee-for-service system would result in decreased remuneration, **and** might be compensated for by increasing fees as the alternative option of higher throughput is limited by reduced demand.
- Alternatively, less demand leaves more time for the individual consultation, **and** thus providers might push consultations into higher fee brackets negating the desired funder's savings agenda.
- Spending more time with the patient is desirable **as** time is a validated global proxy of quality of care—longer consultations result in greater patient enablement [18–20] and are more effective—better understanding of the patient's problems results in less resource use [21–23].
- More time with the patient might provide more opportunities to address the patient's conditions in generalist ways [24] **and** thereby further enhancing the effectiveness and efficiency of primary care (the 'paradox of primary care' [25]).
- Reduced health anxiety would lead to fewer visits for self-limiting disease and might allow better access and care for patients currently presenting to hospital with 'primary care sensitive conditions', **but** many of these admissions result from lack of social support [26]. Adding social support services to the practice team may offset (some) cost savings, **but** would still result in overall cost savings **and** more importantly result in better quality-of-life for at-risk patients.
- Funders ought to recognise higher value of care (its definition being vigorously contested) **and** remunerate GPs for their increased effectiveness, the form of which might be higher fees for high value services or various forms of incentive payments. This would be a win-win solution as it achieves the policy objective of making the health system more sustainable by having a healthier population.

## 8. General Practice should Lead Primary Care Reform

Meaningful and sustainable primary care reform can only be achieved if all stakeholders—patients, health professionals, funders and politicians—engage in eliciting the *shared values* that underpin a *shared vision* for a *shared new approach* [10,27]. Modelling the *Ecology of Medical Care* offers general practice a *shared learning tool* to lead primary care reform. The arising challenges facing stakeholders, like

- How to change people's perception that healthcare alone will improve their health?
- How to overcome the vested interest thinking of people, health professionals, health product suppliers and funders?
- How to achieve a fair remuneration system based on high value rather than high volume care?

- How to enhance intrinsic rather than monetary motivations to work in healthcare?
- How to achieve a realistic portrayal of ‘risk of disease’ and the medical profession’s ‘ability to cure’?
- How to distinguish between necessary and unnecessary healthcare interventions?
- How to affordably implement new technologies and therapies of proven value?
- How to remove obstacles that prevent patients receiving necessary care at the right time?
- How to change the focus of the health system on patient wellness and function rather than maintaining the sole focus on disease-specific management protocols?
- How to engage all healthcare providers in addressing the social determinants of health, and
- How to foster a collaborative approach in preventing disease and promoting health?
- How to overcome the medico-legal threats promulgating the practice of ‘defensive medicine’?
- How to make the ‘experience of health’ the accountability measure of the health system?

They have *no easy answers* [28]. Leadership entails engaging all involved and being transparent in defining the problem and potential solutions. Leaders facilitate the *necessary adaptive work that needs to be done* to reach acceptable and workable solutions [28]. We hope this paper might offer an outline how this could be achieved, as only *mutually agreeable solutions adapted to local circumstances* will ultimately achieve a sustainable health system.

### Conflict of Interest

The authors declare that they have no conflicts of interest.

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