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Primary Health Care Limited's submission to the Senate Standing Committee on Community Affairs

Availability and accessibility of diagnostic imaging equipment around Australia

5 October 2017

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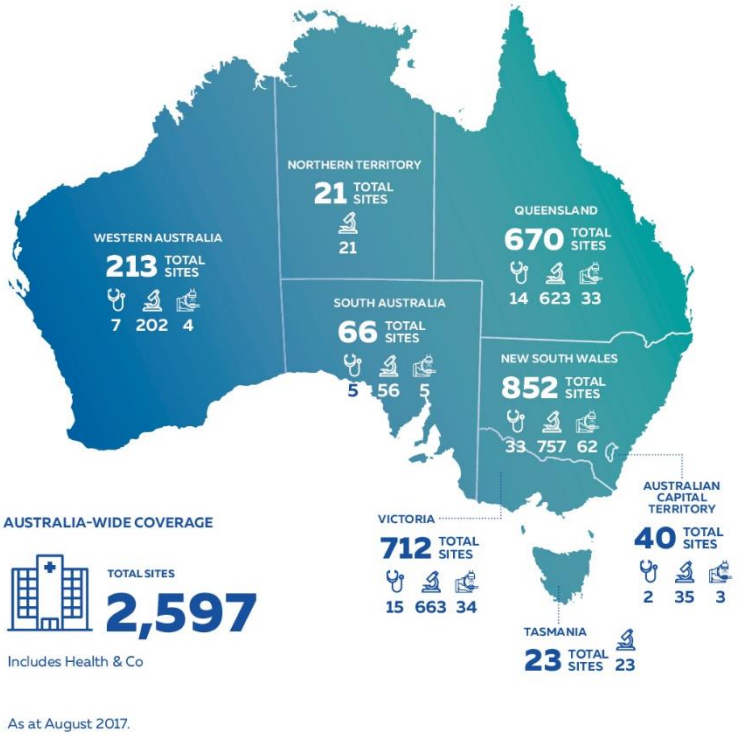
Introduction to Primary

Primary Health Care Limited ('Primary') is one of Australia's leading providers of multi-disciplinary medical centres, pathology laboratories and diagnostic imaging centres, committed to providing quality and affordable services and proud to play a major role in maintaining the health of Australians.

Within diagnostic imaging (DI), Primary conducts more than 3 million radiology examinations per year (approximately 9% of the total scans performed in the community each year[1]), covering x-ray, computerised tomography (CT), magnetic resonance imaging (MRI), mammography, bone densitometry, angiography, ultrasound, echocardiography, fluoroscopic screening, orthopantomography (OPG) and nuclear medicine across 141 sites.



Core to Primary's philosophy is the provision of high quality services that maximise the accessibility of DI to the community and ensure affordability predominantly through bulk billing payment mechanisms. Primary has been able to maintain access to bulk billing diagnostic imaging services for the community, particularly in lower socioeconomic and rural and remote parts of the country, through efficient and innovative business operating models.

[1] Deloitte Access Economics, *Independent evaluation of the commercial environment of comprehensive diagnostic imaging practices*, April 2017, retrieved from: http://www.adia.asn.au/

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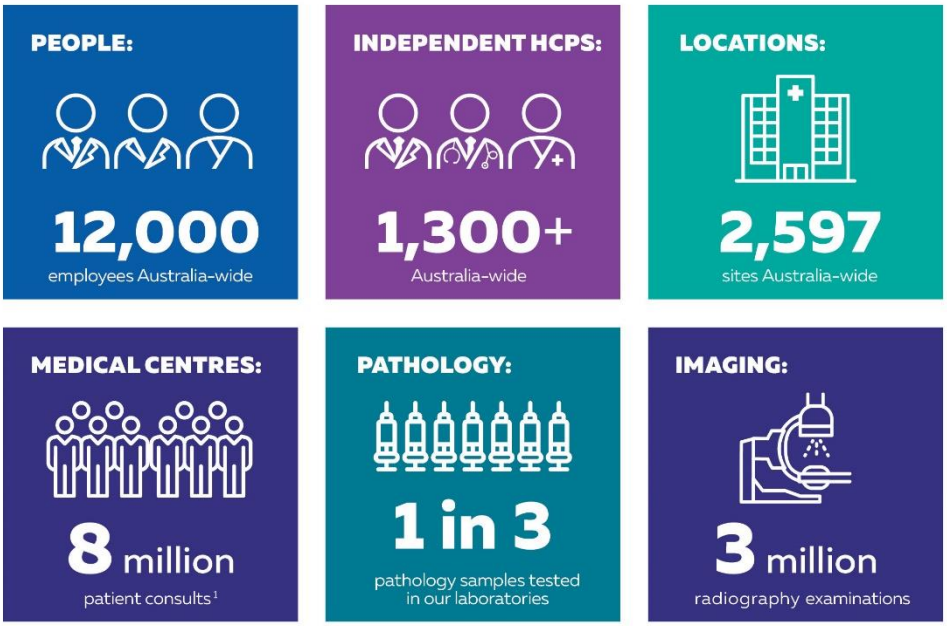
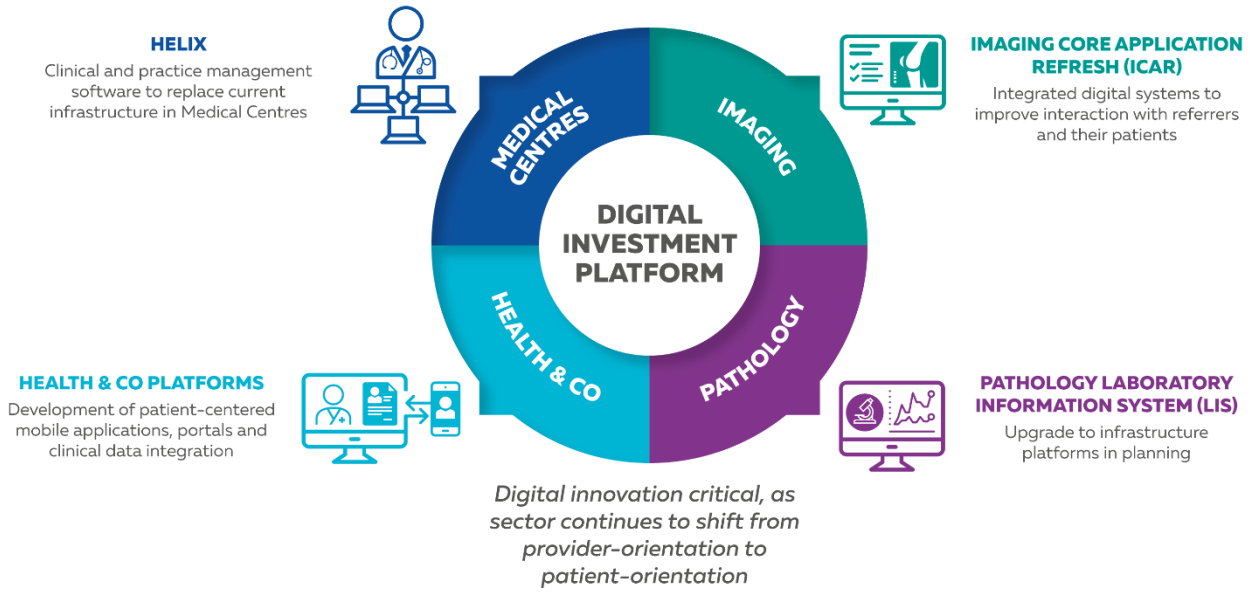


1 All numbers as at 30 June 2017.

Looking towards the future, Primary is preparing for the significant changes anticipated to occur in both diagnostic imaging and primary care. Advances in imaging technologies, the use of artificial intelligence (AI) to enhance the safety and efficiency of radiology by monitoring reports and flagging abnormalities for radiologists to prioritise, wearable devices, remote monitoring, automation, the use of cognitive technologies, big data, and an increasing focus on patient outcomes will result in significant changes to the way diagnostic imaging is provided to the community. Primary's Digital Transformation Strategy is looking at ways to identify and adopt innovation opportunities.



Internationally and in Australia, the impact of these trends and the resulting technologies are changing the way care is delivered, how it is delivered and where it is delivered. Recently in the US, there are technologies already changing care delivery by completing activities previously performed by humans with greater speed, accuracy and using fewer resources. As an example, the first deep learning cloud based imaging software, Arterys Cardio DL™, has been approved by the US Food and Drug Administration to help radiologists read MRI images using automated and editable ventricle segmentations[2]. Policy makers, funders and providers need the agility to keep pace with the new rate of change.

Primary believes that any changes to current arrangements for diagnostic imaging need to be made with a focus on the future of diagnostic imaging. Changes need to support the introduction of technological advances that will improve patient experience and health outcomes, without constraining those advances through regulatory requirements that may be designed to shore up one interest group's position in the diagnostic imaging landscape.

> "Rather than pushing off machine intelligence as being a threat to their job, instead, radiologists should engage it, because it's something that can really help patients. I'm sure it will dramatically change what radiologists do over the next ten years, but you should also keep in mind that eventually, radiology ten years ago was nothing like what it is today."
>
> Bradley Erickson, Director of the Radiology Informatics Lab at Mayo Clinic

[2] https://arterys.com/

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Summary of our submission

The Primary submission addresses each of the Inquiry's Terms of Reference, as summarised below:

1. Geographic and other disparities in access to diagnostic imaging equipment

Clear geographic and economic disparities currently exist in relation to patient access to DI. In broad terms, the further away a patient is from a major metropolitan centre, the harder it is to access DI services, and the more the patient will pay. This inequity of access and affordability is something that Primary has sought to overcome through maintenance of bulk billing DI services in lower socioeconomic areas and rural and regional centres. It is important to note that the proposed Diagnostic Imaging Quality Framework Proposal ('Quality Framework')[3] will serve to increase these disparities without improving clinical outcomes, as the scarcity of radiologists in rural and regional Australia would limit important imaging modalities such as MRI and CT to large metropolitan centres and further reduce access to these life-saving imaging technologies. In addition, there is a lack of evidence supporting the changes. In fact, there is evidence contrary to the proposed supervision changes to non-contrast CT[4].

2. Arrangements for Commonwealth subsidy of diagnostic imaging equipment and services

Whilst Primary is supportive of re-indexation of Medicare Benefits Scheme (MBS) payments for DI, we would like to work with government to ensure that it is re-instated in a way that protects the affordability and accessibility of services for patients. With any reintroduction of indexation of MBS funding it will be important for the Senate Community Affairs Committee to consider how it can ensure that there is a reduction in out-of-pocket expenses for patients that is commensurate with the level of increase in MBS payments that the DI provider will be receiving. If this is not adequately addressed, any reintroduction of MBS indexation for DI will simply result in cost escalation within a Commonwealth funded MBS system that is already under pressure, with no benefit to patients in terms of improved access or affordability for DI services. In addition, Primary believes that further consideration should be given to subsidy arrangements that would address the inequity in access and affordability for rural and remote patients through provision of funding incentives for bulk billing DI services in remote, rural and disadvantaged population groups.

3. Out-of-pocket costs for services that are not subsidised by the Commonwealth and the impact of these on patients

Out–of-pocket payments (or 'gap' payments) for services are a significant roadblock in the early diagnosis and treatment of disease for some patients. Therefore, efforts to incentivise the provision of bulk bill services are encouraged. However, in cases where practices are unable to bulk bill, the current full upfront payment model (i.e. patients pay the rebate + gap and are reimbursed later) places significant financial strain on patients,

[3] Australian Diagnostic Imaging Association and the Royal Australian and New Zealand College of Radiologists (RANZCR), *The DI Reform package: A Quality Framework to underpin sustainable, quality medical imaging*, retrieved from: https://www.ranzcr.com/documents/2236-quality-model-for-diagnostic-imaging/file

[4] Development of Best Practice Professional Supervision and Reporting Standards for Radiologists, June 2006, Australian Healthcare Associates Pty Ltd.

especially those having to pay for multiple scans. Primary would therefore encourage the Committee to consider mechanisms to allow gap-only payments (for non-bulk bill patients) as it will reduce the short term financial strain on patients and their families and increases transparency.

4. The respective roles of the Commonwealth, States and other funders in ensuring access to diagnostic imaging services.

The Commonwealth, States and Private Health Insurers all have key funding roles that can impact on patient access to diagnostic imaging services. At present, cost shifting behaviours that drive the States to undertake Privately Referred Non-Inpatient (PRNI) diagnostic imaging are perversely impacting the provision and cost of DI services in Australia. Because the States have a mechanism to shift costs of non-inpatient diagnostic imaging to the Commonwealth, they have no incentive to limit the number of inappropriate imaging procedures, nor to refer patients for community-based imaging and follow up. This has the effect of locking patients into care and follow up in expensive hospital settings when more appropriate services are available, but are not utilised by States, as they seek revenue from the MBS. A review of funding arrangements to support an effective transition from hospital to community diagnostic imaging is encouraged. As a minimum, there needs to be greater collaboration and joint planning for diagnostic imaging between States and Commonwealth, as well as removal of current cost shifting incentives that have driven growth in non-inpatient imaging in State managed hospitals. Over the longer term, bundled payment models (which include diagnostic imaging) may be appropriate. Primary is actively involved in working with the Commonwealth in understanding the costs, benefits and funding considerations associated with bundled funding models through the Health Care Homes program (see Appendix 2 for Primary's involvement). Consideration of future funding arrangements for DI should be cognisant of changes to broader funding models for primary care and chronic disease management.

The following section of the submission provides greater detail on each of these issues and is structured around the four terms of references communicated by the Senate Committee.

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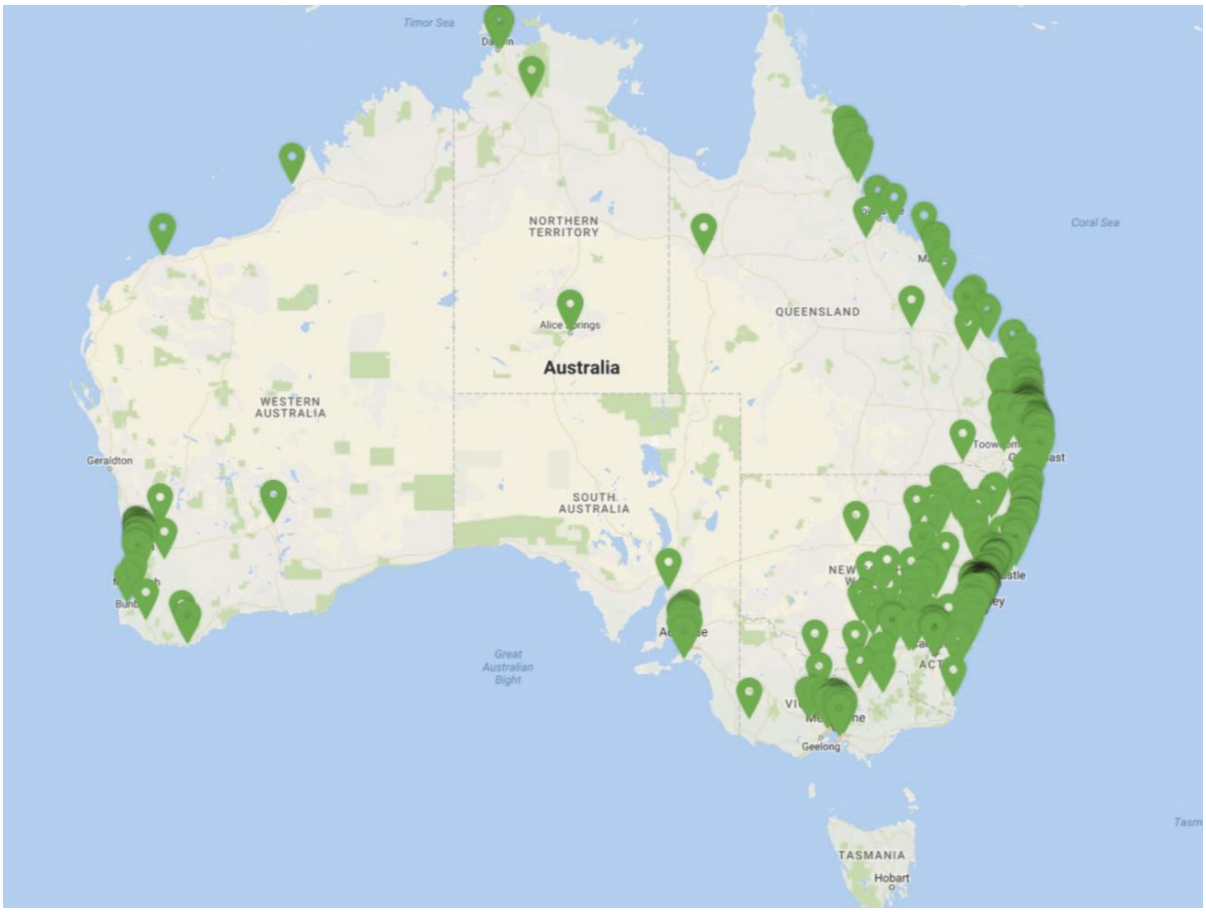
1) Geographic and other disparities in access to diagnostic imaging equipment

Currently there exists geographic and economic disparities exist in accessing diagnostic imaging equipment, meaning that some patients (typically those with higher socio-economic statuses living in metro areas) have better and, in some cases, more timely access to imaging services.

Geographic disparities

Those living in rural and regional Australia are often disadvantaged as service volumes and travel distance between communities make the provision of services more difficult. In addition, a 2016 independent report identified that rural patients pay almost 25% more for diagnostic imaging than inner city patients (the average out-of-pocket payment was $86 per service for inner city patients and $107 for rural patients[5]).



Primary has sought to ensure geographically dispersed communities are provided with affordable accessible diagnostic imaging services. As outlined below (see Table 1), 60% of Primary's DI services are provided for those with geographic or socioeconomic disadvantage. Primary would favour changes to current funding arrangements to incentivise provision of DI services to these communities. Going forward, there needs to be greater planning

[5]Deloitte Access Economics, *Mind the gap: consideration of an up-front only payment model in DI*, commissioned by the Australian Diagnostic Imaging Association, Feb 2016, retrieved from: http://www.adia.asn.au/media-resources/publicationssubmissions/

and coordination of DI services against the needs of local communities. Greater collaboration between Commonwealth and State Governments in planning services to meet population needs.

Table 1. Breakdown of Primary's geographic distribution (FY17)

Geography	Total Exams FY17	Exam %
Inner Metropolitan	1,217,502	40%
Outer Metropolitan	1,046,965	34%
Provincial	296,098	10%
Rural	516,942	17%
Total	**3,077,507**	

Economic disparities

Currently, the out of pocket costs of scans and tests limits access to potentially life-saving DI services for some patients. Patients from lower socio-economic groups unable to access concession cards are often the hardest hit, especially those with complex diseases requiring ongoing monitoring. The issue is further compounded by the fact that clinically complex services used by the sickest patients attract the highest gaps[6].

Primary aims to mitigate these disparities through treating patients via a network of practices located within low to moderate socio-economic status regions where the Socio-Economic Indexes for Areas (SEIFA) is below 1,000 (25 sites serve those in the 1st and 2nd decile). Specific strategies employed by Primary to address economic disparities, include:

- Providing access to bulk bill payment services
- Providing access in local communities (rather than in major hubs only) as these patients often have a higher reliance on local providers of healthcare due to the cost of travel and time away from work.

It is critically important that the work of the Senate Community Affairs Committee examines ways to increase rates of bulk billing for DI services, and does not recommend the introduction of regulatory or other protectionist frameworks that will worsen accessibility to DI services for the poorest in our community.

Proposed changes will increase the gap

The proposed Quality Framework (put forward by Australian Diagnostic Imaging Association (ADIA) and the Royal Australian and New Zealand College of Radiologists (RANZCR))[7] risks increasing geographic and economic disparities in access to DI services. Primary is deeply committed to improving the quality of DI services, and has been at the forefront of introducing new scanning technologies to improve access to high quality imaging services. However, Primary does not believe the proposed Quality Framework is designed to improve the quality

[6] Australian Diagnostic Imaging Association, Submission to the Senate inquiry into out of pocket costs in Australian Healthcare, May 2014, retrieved from: http://www.adia.asn.au/media-resources/publicationssubmissions/
[7] Australian Diagnostic Imaging Association and the Royal Australian and New Zealand College of Radiologists (RANZCR), *The DI Reform package: A Quality Framework to underpin sustainable, quality medical imaging*, retrieved from: https://www.ranzcr.com/documents/2236-quality-model-for-diagnostic-imaging/file

of DI services, rather it is an attempt to enhance the role of one group of stakeholders in the setting of imminent technological disruption to their historical roles in DI. Increasingly DI services will make use of technological advances that will allow machine learning and artificial intelligence to improve the accuracy of reporting of CT, MRI and other imaging modalities (see case study below).

Case Study – Watson Health

One of the most well known examples of automation in medicine is the advancements made by Watson Health (an organisation that brought IBM Watson and Merge, global imaging solutions company, together). The two organisations have combined their AI technology and with advanced PACS systems giving them the ability to scan through thousands of images and identify the ones that the radiologist should investigate more closely. This is not a product feature yet but one likely to be released next year. The impact will profoundly change protocols, quality and roles played by the imaging team.

While Primary acknowledges the important role radiologists play in complex high end interventional imaging procedures, in many parts of the world machine reporting of diagnostic imaging for routine procedures is already common practice. The acceptance of the 'Quality' framework would unnecessarily prevent the introduction of new technologies that will improve the quality of reporting and hence outcomes for patients. The practice of medicine is intended to be an evidence-based science. Unfortunately, the supervision rules proposed in the 'Quality' framework with regard to non-contrast CT imaging services are not evidence based, and will have a negative impact on the affordability and accessibility of diagnostic imaging services. In fact, an independent report did not support a rules based approach to supervision of non-contrast CT[8]. The practical reality is that Australia does not have enough radiologists in the country to provide the level of supervision outlined in the RANZCR 'Quality' framework for current diagnostic imaging services around the country, let alone for the DI services that will be needed over the next decade as the population grows and ages. A number of other unintended negative outcomes can be predicted should the supervision rules be enacted:

- Increased workforce costs pressuring provider margins to such an extent that providers would have to reconsider the provision of services and/or reduce the ability to bulk bill, detrimentally affecting the accessibility of services for over 13 million Australians.
- To cover the new workforce costs of a full time radiologist, practices would need to introduce new out-of-pocket charges for patients of $274.32 per CT scan.[9]

[8] Development of Best Practice Professional Supervision and Reporting Standards for Radiologists, June 2006, Australian Healthcare Associates Pty Ltd.
[9] Primary Health Care Limited analysis

- The closure or consolidation of services, as there are insufficient numbers of qualified radiologists to be present at all practices. This would ultimately disadvantage patients, hindering their ability to get timely access to services and could increase downstream costs caused by delayed diagnostics.
- Is contrary to the broader trend in healthcare which is diversifying roles (e.g. nurse practitioners). This change means that highly specialised team members are able to focus only on the most complex areas of care.
- Negating the return on investment from some of the significant investments already made by the Commonwealth and States into the development of stronger teleradiology services.
- Adding unnecessary complexity and redundancy into the system, and underutilising the valuable skills of radiologists, for three reasons: (1) radiographers already operate non-contrast CT scans safely without radiologists present, (2) the role of the 'supervising radiologist' is already redundant in some cases e.g. low complexity scans, and (3) it would be made more so with the advent of cognitive technologies and artificial intelligence tools that will improve machine based reporting of scans.
- Creating unnecessary burden on the system that needs to be instead preparing for the prospect of new technologies performing an oversight or assessment role (rather than an additional supervising radiologist).

At its core, the increased workforce costs associated with the proposed changes to supervision rules are prohibitive for providers and patients, be crippling to DI businesses, would reduce affordability and reduce accessibility to DI services for most Australians.

Primary has previously submitted an alternative set of recommendations to the Department of Health (October 2016) that better represents the delivery of quality services. These recommendations are based around five key areas of concern:

1. Has no evidence base to support the notion of regulated radiologist supervision improving either quality or safety outcomes for patients
2. Compromises industry efficiency gained over recent years through the widespread use of teleradiology and modern communication systems
3. Ignores the radiologist workforce requirements in Australia that would be necessary to meet the proposed on-site requirements
4. Arbitrarily prescribes an attendance level by radiologists that does not reflect the trends and diversity in contemporary radiology practice
5. Stops innovation in the sector.

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2) Arrangements for Commonwealth subsidy of diagnostic imaging equipment and services

Support for re-indexation

Commonwealth subsidisation of all medical services and equipment is scrutinised by governments, patients and providers to ensure the most appropriate and evidence based services are supported. This is going to become increasingly important as pressure to constrain healthcare spending increases. Since 2008, MBS rebates for diagnostic imaging services have been frozen. This has meant that providers have had to look for other mechanisms to maintain a commercially sustainable business in the context of rising workforce costs and increasing patient demand.

In order to be able to continue to provide affordable and accessible DI services, it is important that the MBS keeps pace with the real costs of the provision of DI services. The high capital costs of this sector, regulatory requirements mandating regular capital replacement and the continued emergence of high cost technological innovation all mean that DI providers face enormous challenges in continuing to bulk bill patients while the MBS payments remain frozen. Primary is, therefore, supportive of re-indexation and is eager to ensure that it is re-instated with appropriate measures to ensure the affordability and accessibility of services is maintained. As re-indexation of MBS funding is introduced it will be important for the Senate Community Affairs Committee to consider how it can ensure that there is a reduction in out-of-pocket expenses for patients that is commensurate with the level of increase in MBS payments that the DI provider will be receiving. If this is not adequately addressed, any reintroduction of MBS indexation for DI risks cost escalation within a Commonwealth funded MBS system that is already under pressure, with no benefit to patients in terms of improved access or affordability for DI services.

Focus and investment in new technologies and a willingness to embrace new models of care

DI is an area of medicine likely to be disrupted by new technologies that will fundamentally change the way services are provided. There is an opportunity now to think carefully about the likely impacts, plan for change and proactively implement strategies (including funding models) to take advantage of the new ways of working. Some of the major trends likely to affect the industry include:

- **Virtual care** – diagnostic imaging is already seeing the impact of virtual care through the use of remote reviews of scans by radiologists in other parts of hospitals, other countries and the world. This trend will only continue to grow as the sophistication of Radiological Information Systems and Picture Archiving and Communication Systems (RIS-PACS) enables more parties to securely access images from remote locations. In the UK, there are already arrangements with providers in different time zones to enable the timely and cost effective review of scans in a 'follow the sun' approach.
- **Community and integrated care** – due to the unsustainable costs associated with treating people in hospitals and the rise in chronic disease, systems around the world are trying to ensure people are

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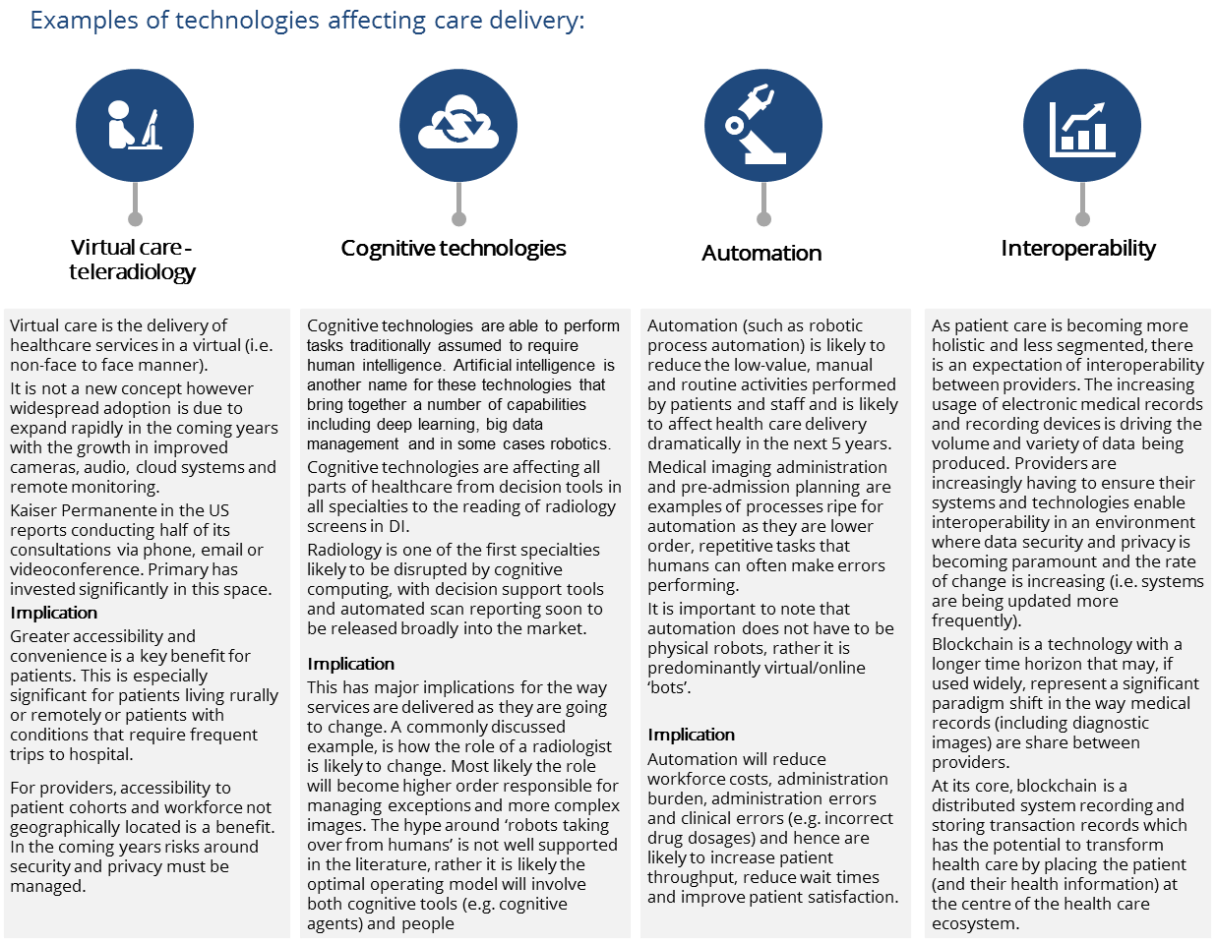
treated closer to home in the community. This change will require government and private providers to work together to ensure sufficient services are available to keep people out of the acute setting.

- **Cognitive technologies** – these technologies have broad ranging impacts on diagnostic imaging that need to be anticipated and planned for to ensure opportunities are realised and changes can be managed. Healthcare is able to learn from other industries already facing significant disruption[10].

  Currently in the marketplace AI is being used in three key ways. First, it is used to flag studies for radiologists to prioritise (i.e. urgent studies). Second, it is being used as a checking mechanism to improve quality. Third, it is performing the 'second read' activity for radiologists, again a quality improvement role. The prevalence and impact of these initiatives is only likely to increase. The diagram below highlights a number of new technological trends currently affecting or due to affect the delivery of diagnostic imaging.

  For more information on cognitive technologies refer to Appendix 1.



[10] Buescher, B., and Viguerie, P., 2014. *How US healthcare companies can thrive amid disruption,* McKinsey and Company

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There are many examples of simple AI-driven technologies already being rolled out in practices internationally such as cameras that can track whether staff wash their hands,[11] to more complex technologies not yet fully operationalised such as using imaging systems to help recognise signs of early pathology in Alzheimer's patients[12], or in the early diagnosis of lung problems/disease. Early detection and the subsequent monitoring of any issues ('prevention medicine') is likely to save significant costs downstream. Funding mechanisms that incentivise people to engage in screening programs are encouraged and need to include consideration of tests aimed at less prevalent illnesses.

Therefore, funding in the future needs be directed towards schemes that support the introduction of innovative technologies and models of care in ways that will help the industry prepare. At the same time, funding needs to continue to support regular review of funding mechanisms and prices to ensure they are aligned with new delivery models, and that people are incentivised to engage in early screening programs.

> "Artificial intelligence will not replace radiologists. Yet, those radiologists who use AI will replace the ones who don't."
>
> Curtis Langlotz, Professor of Radiology and Biomedical Informatics at Stanford University

[11] Haque, H., et al. 2017. Towards Vision-Based Smart Hospitals: A System for Tracking and Monitoring Hand Hygiene Compliance, Journal of Machine Learning Research, Volume 68.
[12] Amorosa, N. et al., 2013. Brain structural connectivity atrophy in Alzheimer's disease, Brain Connect.3(4): 407-22.

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3) Out-of-pocket costs for services that are not subsidised by the Commonwealth and the impact of these on patients

The management of out-of-pocket costs is a focus for Primary as a large proportion of patients are socio-economically disadvantaged and unable to pay gap fees. This is difficult for the industry as a whole as the increased cost of operations has escalated while rebates have remained fixed. The Grattan Institute estimates that out-of-pocket costs rose by 16% between 2007 and 2013, and are likely to have only increased since then[13].

Primary has sought to implement a range of operational efficiencies to ensure costs are minimised and hence patient fees kept to a minimum, and to zero wherever possible. Any influences that will cause providers to introduce or increase gap payments should be avoided as these will only decrease service affordability for patients.

Gap-only payment mechanisms to increase transparency in out-of-pocket payments

In some instances, providers across the industry are unable to offer bulk billing services, or they offer a differentiated service that warrants additional payment. In these instances, it is important that patients are able to compare the price of services between providers. Currently this is difficult as non-bulk bill patients pay the full cost of the service (rebate + gap). The rebate is then processed by the practice and patients receive the rebate amount generally within three days (this is not always possible for complex claims).

The upfront payment system places significant financial strain on some patients, especially those having to pay for multiple scans at once (see Table 2 for industry average upfront fees).

Table 2. Average out-of-pocket payments per modality across the industry, 2009-2010[14]

Modality	Upfront fee per service	MBS rebate per service	Out-of-pocket payment per service
Diagnostic radiology	95	52	43
Ultrasound	187	110	77
CT	411	297	114
MRI	498	362	136
Nuclear medicine	542	447	95

Primary therefore supports further investigation and planning into a gap-only payment model for non-bulk billed patients as it:

- Encourages patients, especially those with lower disposable incomes who require multiple scans, to access imaging services in a timely manner
- Increases transparency around the quantum of out-of-pocket costs vs rebate
- Is more convenient for consumers
- Is easier for patients to understand
- Enables patients to more easily compare between providers.

[13] Duckett, S. and Breadon, P., 2014. Out-of-pocket costs: hitting the most vulnerable hardest, Grattan Institute
[14] Australian Diagnostic Imaging Association, Submission to the Senate inquiry into out of pocket costs in Australian Healthcare, May 2014, retrieved from: http://www.adia.asn.au/media-resources/publicationssubmissions/

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4) The respective roles of the Commonwealth, States and other funders in ensuring access to diagnostic imaging services.

The roles of Commonwealth, States and other funders of diagnostic imaging services are complex, interconnected and changing rapidly with the introduction of new policies and standards. There is an inherent challenge in ensuring that role delineation exists between providers, while at the same time providing a seamless patient journey over the course of an illness or lifetime. This is a major challenge facing most health systems, including Australia.

Commonwealth, States and other funders need to work together to ensure funding arrangements drive the most appropriate patient care. In some cases, funding arrangements drive perverse incentives. For example, as the Commonwealth funds hospital non-inpatient scanning, while States fund hospital inpatient scanning, there is a tendency for patients to receive diagnostics as outpatients (privately referred non-inpatients), driving up costs to the MBS through cost-shifting mechanisms between different governments.

The incentive to 'overscan' in the hospital non-inpatient setting potentially duplicates work already performed, or better performed, in the community. This suggests that new incentives are needed to support an effective transition from hospital to community diagnostic imaging. As a minimum, this requires greater collaboration and joint planning for DI between States and the Commonwealth, but could also include harder incentives, such as constraints on acute non-inpatient scanning growth at an individual facility level.

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Conclusion

Primary is one of the few parties in the DI landscape that, on a daily basis, delivers affordable access to DI for all segments of the community through its continued commitment to bulk billing. Primary is committed to driving real improvements in quality, access and affordability of DI in Australia, and is engaged in helping to shape future policy in this area. We do not believe the proposed RANZCR Quality Framework will do that. Rather, Primary supports the reintroduction of indexation in a way that does not increase out of pocket costs for patients, reduce access to DI services for disadvantaged and rural communities and cost lives as people choose not to access unaffordable diagnostic imaging.

Primary welcomes the opportunity for ongoing dialogue, and would be willing to provide further detail in support of this submission, should doing so aid the work of the Inquiry. We are also willing to make ourselves available to appear before the Inquiry at any time.

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Appendix 1

Overview of cognitive technologies.

Cognitive technologies

Defining cognitive technologies
Cognitive technologies are products of the field of artificial intelligence (AI). They are able to perform tasks that only humans used to be able to do.

Computers cannot think. But increasingly, they can do things only humans were able to do. It is now possible to automate tasks that require human perceptual skills, such as recognising pathology or identifying emotions, and those that require cognitive skills, such as planning, reasoning from partial or uncertain information, and learning. Technologies able to perform tasks such as these, traditionally assumed to require human intelligence, are examples of cognitive technologies. In DI, a practical application of AI are technologies that help radiologists read or sort images

Examples of cognitive technologies

1. **Amelia,** a **cognitive agents** performs pre-admission administrative processes with patients entering a hospital or medical centre
2. **Pillo,** an **AI healthcare companion,** uses the latest in voice and facial recognition technologies to hear, see and understand natural language. This enables him to adapt his functionalities to serve consumer specific needs

Working hand in hand
Despite the impressive capabilities of cognitive technologies, nothing we have seen suggests that a wholesale replacement of human workers by robotic substitutes is imminent.

Technologies like speech recognition and machine translation can greatly boost productivity, but they require human oversight if their work is to be as good as humans.

Not only may cognitive systems produce imperfect results, they may also require a significant investment of human time to train or configure before they can do their work. Machine learning systems are routinely exposed to thousands or millions of data elements before they can start reliably making predictions or classifications.

For the foreseeable future, then, the use of cognitive technologies implies that humans will be very much "in the loop"—not only to develop, customize, and train the systems, but also to oversee, guide, and improve them. Indeed, a promising approach that should be followed in the DI industry, is designing systems that make cognitive technologies to work hand-in-hand with people, leveraging the strength of each.

Source: https://dupress.deloitte.com/dup-us-en/deloitte-review/issue-16/cognitive-technologies-business-applications.html
https://www2.deloitte.com/us/en/pages/deloitte-analytics/articles/cognitive-technology-for-health-care.html

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Appendix 2

Deep dive into Primary's role in Health Care Homes, the new initiative trialling bundled payments for patients with chronic and varied health conditions.