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Department of Health and Aged Care

REDUCING OVERUSE OF DIAGNOSTIC IMAGING: PROJECT REPORT

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Reducing Overuse of Diagnostic Imaging: Project Report

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Trial registration

The trial was prospectively registered on the Australian New Zealand Clinical Trials Registry (ACTRN12619001503112) on 31 October 2019.

Ethics approval

This project was approved by the Bond University Human Research Ethics Committee (LA03323).

Research team

This project was conducted by the Department of Health and Aged Care in partnership with Wiser Healthcare.

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Further publications

Billot, L., O'Connor, D., Maguire, B., Schram, D., Ma, R., Buchbinder, R., Maher, C., McCaffery, K., Traeger, A., Albarqouni, L. and Gorelik, A., 2021. Statistical Analysis Plan for the MSK DI AF trial. OSF Preprints. doi:10.31219/osf.io/prnd2.

Traeger, A., Checketts, J., Tcharkhedian, E., O'Connor, D., Klinner, C., Sharma, S., Vyas, P., Albarqouni, L. and McCaffery, K., 2020. Patient and general practitioner views of tools to delay diagnostic imaging for low back pain: a qualitative study. BMJ Open, 10(11), p.e039936. doi: 10.1136/bmjopen-2020-039936.

O'Connor, D.A., Glasziou, P., Maher, C.G., McCaffery, K., Schram, D., Maguire, B., Ma, R., Billot, L., Gorelik, A., Traeger, A.C., Albarqouni, L., Checketts, J., Vyas, P., Clark, B., Buchbinder, R., 2022. Effect of an individualized audit and feedback intervention on rates of musculoskeletal diagnostic imaging requests by Australian general practitioners: A cluster randomized clinical trial. JAMA, 328(9), 1-11. doi:10.1001/jama.2022.14587.

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Overuse of testing in Australia

There is increasing global recognition that the provision of unnecessary health services is a pervasive problem[1]. Overuse of testing, and associated overdiagnosis and over-treatment, occur when people are frequently and excessively referred for medical review that will not change a patient's treatment plan or improve their health outcome. This can be detrimental to the patient's health. For example, overuse of medical tests can increase the risk of exposure to unnecessary and sometimes invasive treatments and procedures[2], and can result in unnecessary exposure to radiation[3], particularly in the cases of X-rays and CT scans. They can also be costly to the patient and the healthcare system.

Work by the Medicare Benefits Scheme (MBS) Review Committee, Choosing Wisely Australia and the Australian Atlas of Healthcare Variation all agree General Practitioner (GP) requested diagnostic imaging can be improved. There is an increasing volume of evidence, both from within Australia and internationally, that is drawing attention to the issue of overuse of imaging in relation to musculoskeletal conditions.

Overuse of musculoskeletal diagnostic imaging

Regional pain in areas such as lower back, neck, shoulder, hip, knee, and ankle are common patient complaints and form a substantial proportion of global disability. Collectively, these conditions are referred to as musculoskeletal conditions. Patients with musculoskeletal conditions are likely to seek initial medical advice from their GPs, who are important stewards in maximising the quality of patient outcomes and providing evidence-based care. Evidence-based guidelines for many musculoskeletal conditions recommend against diagnostic imaging as a first response, unless there are symptoms or features which indicate a serious or specific underlying cause; however, current evidence suggests this is not what is occurring in practice. There may be many reasons why GPs request diagnostic imaging, however, there is a concern that the majority of requests fulfilled in Australia do not result in changed patient care or improved patient outcomes[4]. An overview of possible drivers of overuse and solutions is provided in figure 1 below[5].

1 Brownlee, S., Chalkidou, K., Doust, J., Elshaug, A., Glasziou, P., Heath, I., Nagpal, S., Saini, V., Srivastava, D., Chalmers, K. and Korenstein, D., 2017. Evidence for overuse of medical services around the world. The Lancet, 390(10090), pp.156-168. doi:10.1016/S0140-6736(16)32585-5.

2 Maher, C., O'Keeffe, M., Buchbinder, R. and Harris, I., 2019. Musculoskeletal healthcare: Have we over-egged the pudding?. International Journal of Rheumatic Diseases, 22(11), pp.1957-1960. doi:10.1111/1756-185X.13710.

3 Morrisroe, K., Stevens, W., Sahhar, J., Rabusa, C., Nikpour, M. and Proudman, S., 2017. Epidemiology and disease characteristics of systemic sclerosis-related pulmonary arterial hypertension: results from a real-life screening programme. Arthritis Research & Therapy, 19(1). doi:10.1186/s13075-017-1250-z.

4 Henschke, N., Maher, C., Refshauge, K., Herbert, R., Cumming, R., Bleasel, J., York, J., Das, A. and McAuley, J., 2009. Prevalence of and screening for serious spinal pathology in patients presenting to primary care settings with acute low back pain. Arthritis & Rheumatism, 60(10), pp.3072-3080. doi:10.1002/art.24853.

5 Pathirana, T., Clark, J. and Moynihan, R., 2017. Mapping the drivers of overdiagnosis to potential solutions. BMJ, p.j3879. doi:10.1136/bmj.j3879.

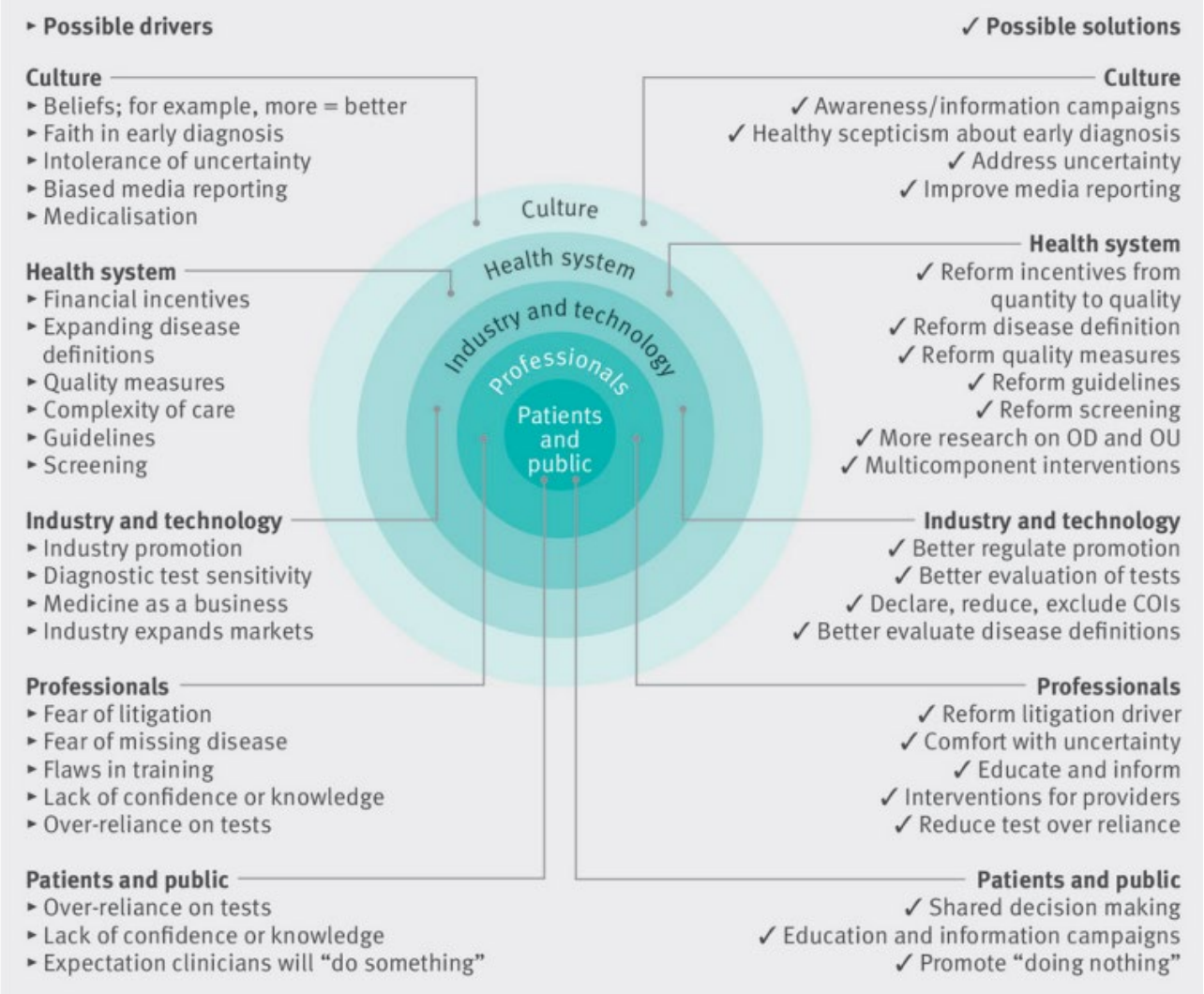

Figure 1 Overdiagnosis and related overuse. Mapping possible drivers to potential interest; COI=conflict of interest; OD=Overdiagnosis; OU=overuse.

Overuse of diagnostic imaging can cause harm to patients in several ways including: increased exposure to ionising radiation for X-ray and CT scans and associated increased risk of harm; identifying incidental findings or "false positives" that can lead to a cascade of unnecessary tests and/or treatments and increased patient anxiety and discomfort. It also exposes the healthcare systems to opportunity costs (i.e., time spent on unnecessary tests reduces time available for necessary tests) and wastage of resources.

Outside of hospitals, diagnostic imaging often originates from requests by general practitioners (GPs). GPs are stewards of evidence-based care and the Medicare system, and therefore play a key role in reducing overuse of diagnostic imaging. One way to support GPs in this role is to raise their awareness of the number of requests they make and support them to limit their requests to only those situations where imaging has a reasonable likelihood of changing a patient's treatment plan and improving their health outcomes.

Randomised controlled trial

The Australian Government has taken a targeted approach to reduce harm to patients and wastage of healthcare resources from overuse of diagnostic imaging by raising GP awareness and supporting clinically appropriate requesting. This approach forms the Reducing Overuse of Diagnostic Imaging Project.

The Department of Health and Aged Care, in partnership with Wiser Healthcare, designed a quality improvement strategy aimed at reducing overuse of diagnostic imaging by high requesting Australian GPs. The strategy was evaluated through a randomised controlled trial (RCT). The strategy aimed to

provide GPs with feedback about how often they requested diagnostic imaging compared with their peers. The RCT evaluated whether this strategy would have an impact on GPs' requesting rate compared to a control group that didn't receive feedback. The RCT also investigated whether different forms of feedback, such as feedback with an enhanced visual display, or feedback delivered on two occasions, would be more effective than the standard approach.

A summary of the project follows. For further details on identification of recipients, trial design, and statistical analyses, see Appendix A. For a more extensive, peer-reviewed publication regarding the project, see O'Connor et al's 2022 paper[6].

The project focused on eleven musculoskeletal diagnostic imaging requests identified as being at risk of overuse. These included: lumbosacral spine X-ray and CT scan; cervical spine X-ray, CT scan, and MRI; shoulder X-ray and ultrasound; knee X-ray; hip X-ray and ultrasound; and ankle/hind foot ultrasound.

3,819 GPs who were in the top 20% of requesters of the targeted diagnostic imaging tests overall, and in the top 20% of requesters for four or more of the individual tests, were allocated to either one of four feedback groups, or to no intervention control (see Figure 2).

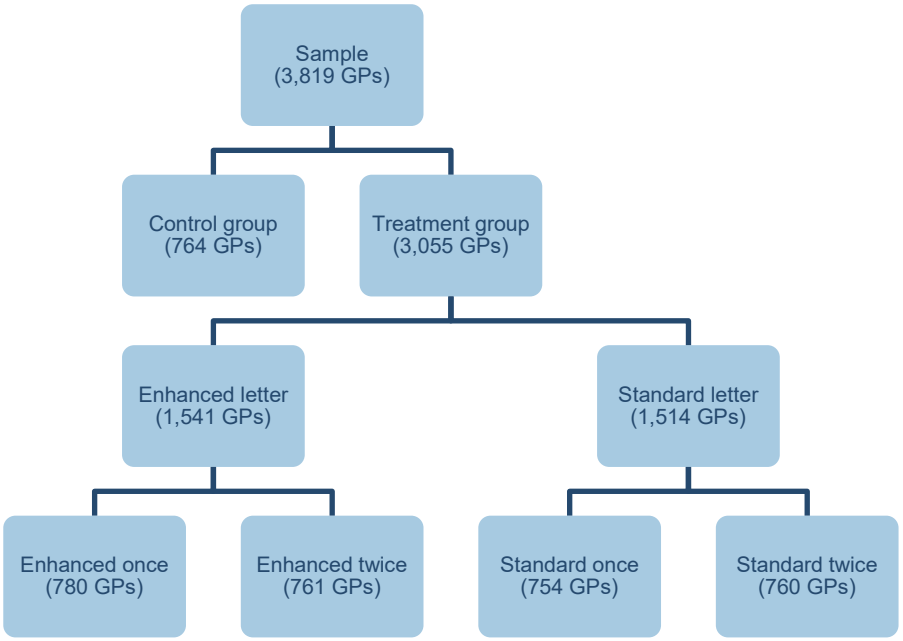

Figure 2. RCT design showing sample numbers at randomisation. For numbers analysed, see Appendix A.

Development of letters

Letters containing feedback about diagnostic imaging requesting rates were developed and refined with input from GPs through user testing and consultation with peak medical organisations.

A variety of letters were drafted, and user tested through semi-structured interviews with volunteer GPs. The RCT evaluated four letter variants, which can be found at Appendices B, C, D, and E. Further information on user testing including methodology and outcomes is available in Traeger et al's 2020 paper[7], which also covers several elements which were user tested but not included in the project.

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[6] O'Connor, D.A., Glasziou, P., Maher, C.G., McCaffery, K., Schram, D., Maguire, B., Ma, R., Billot, L., Gorelik, A., Traeger, A.C., Albarqouni, L., Checketts, J., Vyas, P., Clark, B., Buchbinder, R., 2022. Effect of an individualized audit and feedback intervention on rates of musculoskeletal diagnostic imaging requests by Australian general practitioners: A cluster randomized clinical trial. JAMA, 328(9), 1-11. doi:10.1001/jama.2022.14587. [TBC]

[7] Traeger, A., Checketts, J., Tcharkhedian, E., O'Connor, D., Klinner, C., Sharma, S., Vyas, P., Albarqouni, L. and McCaffery, K., 2020. Patient and general practitioner views of tools to delay diagnostic imaging for low back pain: a qualitative study. BMJ Open, 10(11), p.e039936. doi: 10.1136/bmjopen-2020-039936.

All letters provided GPs with:

- A graph comparing their overall rate of requesting for the 11 targeted musculoskeletal diagnostic imaging tests to that of their peers
- A table comparing request rates for each individual test to their peers
- Encouragement to reflect on whether there were opportunities for them to reduce requesting of diagnostic imaging, where clinically appropriate
- Information on why overuse of diagnostic imaging was not desirable (including inefficacy and potential harm to patients)
- Links to resources on appropriate requesting

The standard letter (see appendix B) was also varied to evaluate two feedback variations separately and in combination:

- Visual display (standard vs. enhanced display)
- Frequency of feedback (one vs. two occasions)

In the enhanced display condition, the table showing requesting rates for individual tests was highlighted with yellow shading where the recipient was in the top 20% of requesters for that test to direct recipients' attention to areas where action may be needed (see appendices C and E).

In the feedback twice condition, the first letter included an additional paragraph advising the recipient that they would receive a second letter in nine to twelve months' time. They then received a second letter providing updated personalised data on their requesting rates, using data from November 2019 to March 2020. This time period was selected to mitigate undue impacts of COVID-19 on requesting rates (see appendices D and E).

As such, GPs were split into five groups:

- The control group (received no letter)
- Standard once (received one letter with the standard display)
- Standard twice (received two letters twelve months apart with the standard display)
- Enhanced once (received one letter with the enhanced display)
- Enhanced twice (received two letters with the enhanced display)

The initial mailout occurred on 8 November 2019. The follow-up mailout for the feedback twice conditions (standard twice and enhanced twice) was sent 12 months later, on 9 November 2020.

The primary outcome of interest was the overall requesting rate for any of the targeted musculoskeletal diagnostic imaging tests for each GP over 12 months. Follow-up data was analysed over 6, 12, and 18 months after the initial mailout.

Coincidently, the timing of this project overlapped with the outbreak of COVID-19 in Australia. The inclusion of the control group ensures that other underlying factors, such as the pandemic, seasonal variations, and so on, can be accounted for in the analysis.

Behavioural insights principles

The design of the feedback letter was informed by empirical[8] and theoretical knowledge about how performance feedback works[9, 10] and behavioural insights principles from the EAST framework, which recommends making desired behaviours easy, attractive, social, and timely (Figure 3):[11]

[8] Ivers, N., Jamtvedt, G., Flottorp, S., Young, J.M., Odgaard-Jensen, J., French, S.D., O'Brien, M.A., Johansen, M., Grimshaw, J., and Oxman, A.D., 2012. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane Database of Systematic Reviews, 6, 1465-1858. doi:10.1002/14651858.CD000259.pub3.

[9] Brehaut, J., Colquhoun, H., Eva, K., Carroll, K., Sales, A., Michie, S., Ivers, N. and Grimshaw, J., 2016. Practice Feedback Interventions: 15 Suggestions for Optimizing Effectiveness. Annals of Internal Medicine, 164(6), p.435. doi:10.7326/M15-2248.

[10] Brown, B., Gude, W., Blakeman, T., van der Veer, S., Ivers, N., Francis, J., Lorencatto, F., Presseau, J., Peek, N. and Daker-White, G., 2019. Clinical Performance Feedback Intervention Theory (CP-FIT): a new theory for designing, implementing, and evaluating feedback in health care based on a systematic review and meta-synthesis of qualitative research. Implementation Science, 14(1). doi:10.1186/s13012-019-0883-5.

[11] Service, O., Hallsworth, M., Halpern, D., Algate, F., Gallagher, R., Nguyen, S., Ruda, S., Sanders, M., Pelenur, M., Gyani, A., Harper, H., Reinhard, J. and Kirkman, E., 2014. EAST: Four Simple Ways to Apply Behavioural Insights. [online] The Behavioural Insights Team. Available at: <https://www.bi.team/publications/east-four-simple-ways-to-apply-behavioural-insights/> [Accessed July 2022].

Figure 3. EAST image reproduced with permission from the Behavioural Insights Team

Easy

- Language simple and specific about recommended actions
- Personalised requesting data for review
- Links to resources to help GPs reduce their requesting

Attractive

- Colours and bold text to draw attention to important information
- Personalised messaging to highlight the relevance of an action

Social

- Peer comparison feedback provided on GP requesting rates

Timely

- Recent requesting data (past 12 months) for review
- (In repeated feedback condition) GPs made aware via follow-up letter of ongoing feedback of their requesting rates

In addition to evaluating the effect of providing GPs with feedback, the project explored the following behavioural insights principles:

Frequency of Feedback – Multiple instances of feedback can encourage a feedback loop and have been associated with increased effects[12]. In anticipation of future instances of feedback, recipients may be motivated to reduce discrepancies between current and desired practice. Further, on receipt of multiple instances of feedback, recipients have the opportunity to observe the impact of their behavioural changes. In the repeated delivery condition, recipients received a second letter providing updated imaging requesting data. It was hypothesised that the second letter would reinforce the first and increase motivation to reduce musculoskeletal diagnostic imaging requests.

Salience – Behavioural insights suggests that we tend to focus on items or information that draw our attention, while ignoring items that do not seem immediately noteworthy. In the enhanced feedback condition, coloured highlighting was used to draw the recipient's attention to areas where their requesting was highest. It was hypothesised that directing the GP's attention to those tests would lead to a greater reduction in musculoskeletal diagnostic imaging requests.

[12] Ivers, N., Grimshaw, J., Jamtvedt, G., Flottorp, S., O'Brien, M., French, S., Young, J. and Odgaard-Jensen, J., 2014. Growing Literature, Stagnant Science? Systematic Review, Meta-Regression and Cumulative Analysis of Audit and Feedback Interventions in Health Care. Journal of General Internal Medicine, 29(11), pp.1534-1541. doi:10.1007/s11606-014-2913-y.

Results

Overall, the project showed that GPs who received feedback on their musculoskeletal diagnostic imaging had a statistically significant lower requesting rate compared to GPs in the control group over 12 months.

As seen in Figure 4, in the 12 months before the feedback was sent, the requesting rates for the two groups were similar, with no statistically significant difference between them. After the feedback was sent the two groups diverge. Apart from a brief re-convergence during the initial outbreak of COVID-19, the feedback group is consistently lower than control over the following 18 months. There was a further reduction in imaging requests after the second feedback letter was sent at 12 months.

Compared to control, feedback resulted in:

- 10.6% relative reduction in imaging requests over 6 months
- 9.2% relative reduction in imaging requests over 12 months
- 8.0% relative reduction in imaging requests over 18 months.

The difference between feedback and control was statistically significant ($p<0.001$) at all time points. These rates indicate an estimated 47,318 fewer diagnostic imaging tests were requested due to feedback over 18 months.

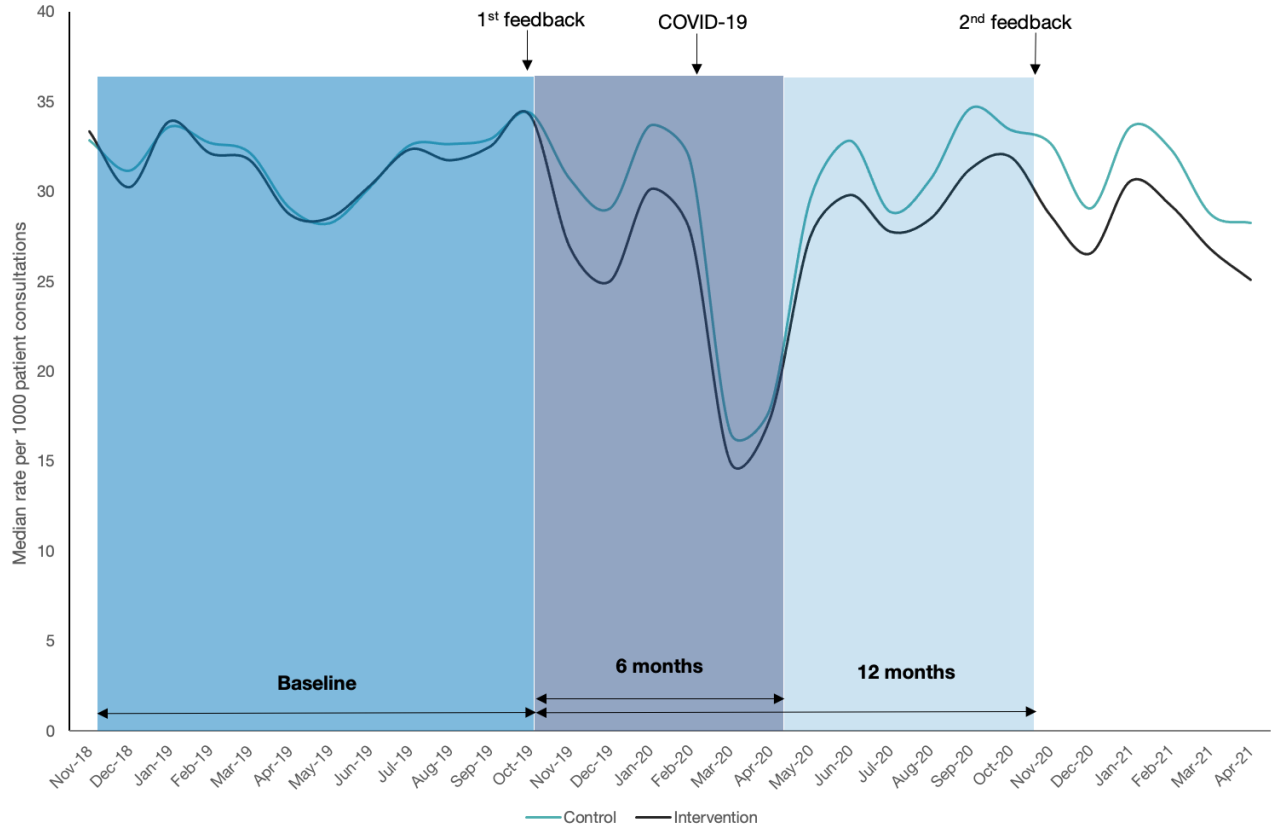


Figure 4. Changes in requesting rates of musculoskeletal diagnostic imaging between feedback (purple line) and no intervention control (black line) over 6, 12, and 18 months, reported as medians

Feedback led to a statistically significant reduction in the request rate of all individual diagnostic imaging tests compared with control over the first six months, with the greatest reductions observed for hip X-ray and lumbosacral spine CT. The request rate remained statistically significantly lower compared to control for all but two individual diagnostic imaging tests over 12 and 18 months: lumbosacral and cervical spine X-ray (see Appendix F for a table listing outcomes for specific diagnostic imaging tests).

There were no statistically significant differences in intervention effects based on geographical location, years practising as a GP, reported sex, or baseline overall percentile ranking.

Compared with the control group, the greatest reduction in overall request rate was observed with enhanced feedback provided on one occasion over six months (12.9%), enhanced feedback provided on one occasion over 12 months (10.3%) and enhanced feedback provided on two occasions (at baseline and 12 months later) over 18 months (9.9%) (Figure 5).

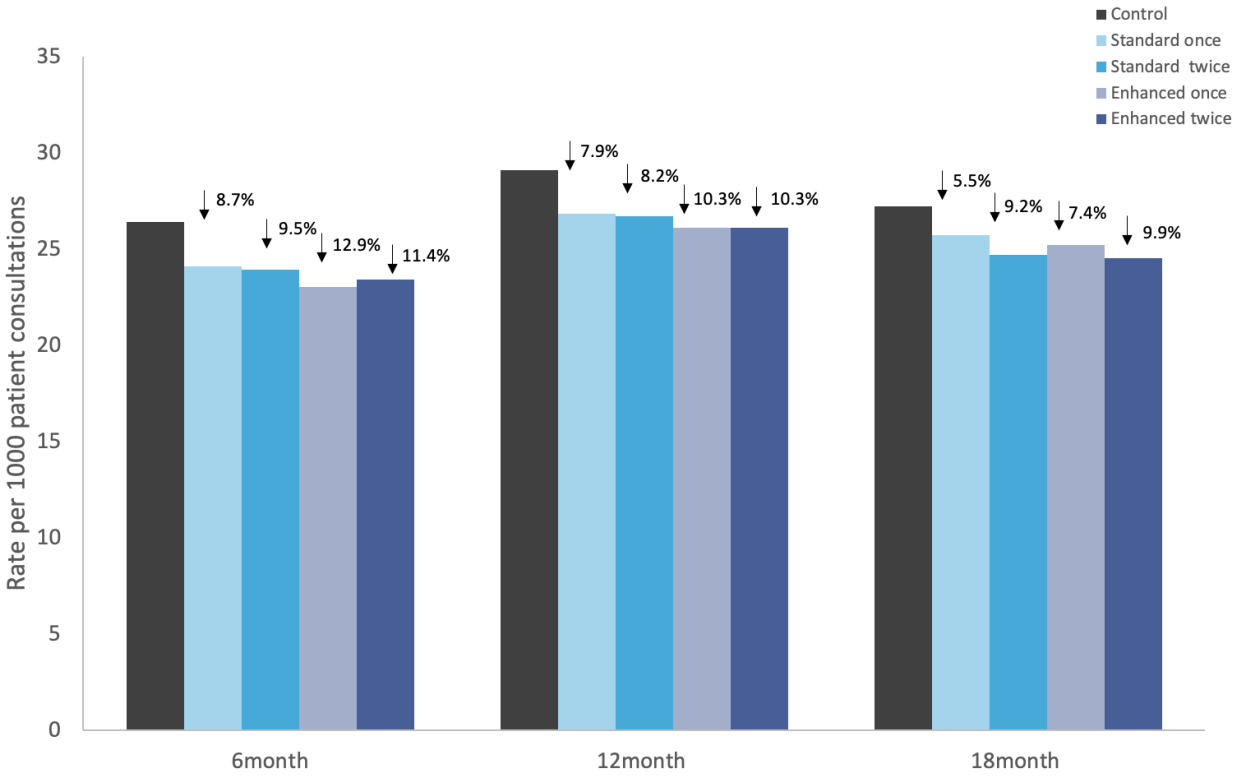


Figure 5. Relative reduction in overall rate of musculoskeletal diagnostic imaging by group over 6, 12 and 18 months

Concluding points

Providing feedback to high-requesting GPs is a relatively simple, low-cost strategy, that was able to significantly reduce overuse of musculoskeletal diagnostic imaging requests at a national scale, reducing the estimated number of musculoskeletal diagnostic imaging tests requested by 47,318 over the study period. Overall, receiving any feedback resulted in a 10.6% relative reduction in the overall rate of imaging requests over 6 months, 9.2% over 12 months, and 8.0% over 18 months compared to no intervention. This project has added to the evidence about the effectiveness of feedback for reducing overuse of diagnostic imaging in primary care. It has also demonstrated that feedback on two occasions and use of a simple display enhancement led to increased effects.

Appendix A – Details of statistical analyses

Overview

This project was conducted as a cluster randomised controlled trial (RCT). GPs who were 'high requesters' of selected diagnostic imaging relative to other GPs practising in a similar geographical region in the period from 1 January 2018 to 31 December 2018 were randomly allocated to either no intervention control or to one of four intervention groups. GPs allocated to the control group did not receive any feedback on their musculoskeletal imaging requests. GPs allocated to one of four intervention groups received individualised written feedback on their imaging requesting rates in a letter from the Chief Medical Officer in November 2019 (with follow-up for the repeated feedback condition sent 12 months later).

A statistical analysis plan (SAP) was published on 6 August 2021[13]. Full details of the analysis can be found in this publication.

Ethics approval

The project was approved through the Bond University Human Research Ethics Committee (LA03323) in August 2019, which assessed the project as complying with the provisions contained in the *National Statement on Ethical Conduct in Human Research*.

Outcomes

The primary outcome was the overall rate of requests for any of the 11 targeted musculoskeletal diagnostic imaging tests (number of requests per 1,000 category 1 consultations) for each GP over 12 months, with rates over 6 and 18 months considered secondary outcomes. The requesting rates for the 11 individual diagnostic imaging tests plus ankle x-ray for each GP over 6, 12 and 18 months were secondary outcomes. Ankle x-ray was not targeted by the intervention but was considered a possible substitute for ankle/hind foot ultrasound.

The dataset recorded the number of diagnostic imaging requests by GPs that were taken to a radiologist and fulfilled. The analysed data does not include non-Medicare requests, or requests that were written by the GP but not filled by the patient.

Under Medicare, there are different item numbers for requests of each type of diagnostic imaging (e.g., CT scan, MRI, x-ray) for each body part (e.g., knee, shoulder). GP requesting rates were examined at both an overall level and based on their requesting rate for each individual test. This allows us to compare a practitioner's requesting to others, even if they are requesting different types of diagnostic imaging.

Items for the following 11 diagnostic imaging types were included:

- Lumbosacral spine X-ray
- Lumbosacral spine CT scan
- Cervical spine X-ray
- Cervical spine CT scan
- Cervical spine MRI
- Shoulder X-ray
- Shoulder ultrasound
- Knee X-ray
- Hip X-ray
- Hip ultrasound
- Ankle ultrasound

[13] Billot, L., O'Connor, D., Maguire, B., Schram, D., Ma, R., Buchbinder, R., Maher, C., McCaffery, K., Traeger, A., Albarqouni, L. and Gorelik, A., 2021. Statistical Analysis Plan for the MSK DI AF trial. OSF Preprints. doi:10.31219/osf.io/prnd2.

Population and sampling

The population of interest was GPs classified as 'high requesters' of diagnostic imaging relative to their peers. A 'high requester' was a GP in the top 20 per cent of diagnostic imaging requesters whose primary practice was in a similar geographic region, based on their requesting rate over the 12-month period before the trial. Regions were defined using the Modified Monash Model[14] (MMM), with the seven levels of the MMM dichotomised to metropolitan and regional/rural/remote.

GPs were selected for inclusion in the sample if they met all of the following criteria between 1 January 2018 and 31 December 2018:

- the GP practiced in an Australian state or territory;
- the GP was within the top 20% of Australian GP requesters of eleven targeted diagnostic imaging requests overall;
- the GP was within the top 20% of Australian GP requesters of at least four individual diagnostic imaging tests; and
- the GP had a minimum of 1000 patient consultations across 12 months.

GPs were excluded from the sample if:

- the GP had not made any requests for the 11 targeted diagnostic imaging tests between 1 January 2018 and 31 December 2018;
- the GP had less than 1,000 patient consultations over the specified 12-month period;
- the GP participated in user testing that informed the development of the feedback letters; and/or
- the GP had been involved in any Department of Health and Aged Care compliance activity after 1 January 2018.

GPs had an equal chance of being in any of the five groups (control or the four intervention groups).

- 764 GPs were in the control group and received no letter
- 754 GPs received the base letter (the "standard feedback" condition)
- 780 GPs received a letter with a variant table highlighting relevant information (the "enhanced feedback" condition)
- 760 GPs received the standard letter and a follow-up letter (the "standard twice" condition)
- 761 GPs received the enhanced feedback letter and an enhanced follow-up letter (the "enhanced twice" condition)

Matching and randomisation

GPs were assigned into clusters based on shared practice locations. Randomisation occurred at the cluster level and was stratified by geographic region (metropolitan or regional/rural). Randomisation was conducted using a computer-generated algorithm in statistical software package R Studio.

Due to an administrative error in practice locality classification, some clusters were misclassified in both strata (i.e., metropolitan, non-metropolitan) leading to GPs from the same practice having a chance of being randomised into different study groups (111 practices to both control and intervention; 196 practices to two different intervention groups). A sensitivity analysis was conducted excluding practices inadvertently randomised into two study groups due to the administrative error and it did not result in a statistically significant change in the results.

[14]Department of Health and Aged Care. 2021. Modified Monash Model. [online] Available at: <https://www.health.gov.au/health-workforce/health-workforce-classifications/modified-monash-model> [Accessed July 2022].

Analysis

For the main analysis, all practices were included with GPs analysed according to their allocated group. The requesting rates for 159 (4.2%) GPs could not be calculated as these GPs did not have any patient consultations during the study period. The main analysis therefore included 3,660 GPs from 2,578 practices and excluded the 159 GPs that had not practised during follow-up (see Figure 6).

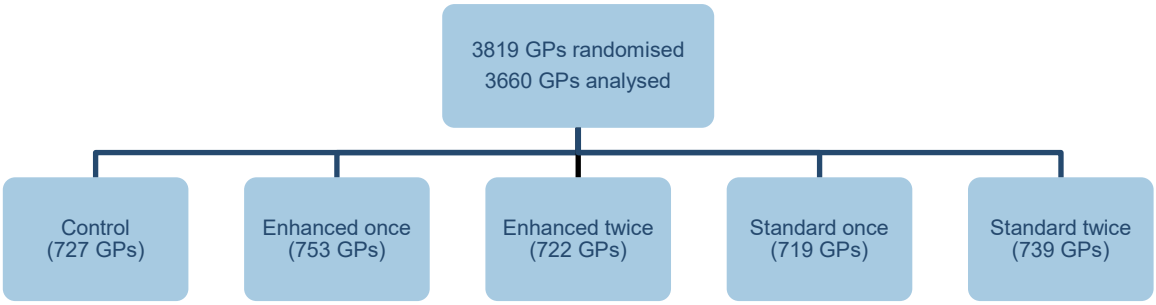


Figure 6: Number of GPs included in analysis by group.

The analysis compared the intervention and control group for each outcome. This was achieved by conducting multilevel mixed effect linear regression analysis adjusted for the baseline imaging rate of each GP and remoteness. The table below presents the results for the main comparison (feedback vs. control) and according to frequency of feedback (twice vs. once) and visual display (enhanced vs. standard).

Table 1: Overall request rate for the main comparison (feedback vs. control) and according to frequency of feedback (twice vs. once) and visual display (enhanced vs. standard)

	Observed rates[15]		**Model based estimates**[13, 16]		
Overall	**Intervention (n=2,933)** **Median (Q1 - Q3)**	**Control (n=727)** **Median (Q1 - Q3)**	**Intervention (n=2,933)** **Mean (95% CI)**	**Control (n=727)** **Mean (95% CI)**	**Adj mean difference (95% CI), p-value**
Baseline	32.4 (27.3 - 38.0)	31.8 (27.5 - 38.2)			
6 months	24.0 (19.0 - 30.5)	26.8 (21.7 - 33.1)	24.8 (24.5, 25.0)	27.6 (27.1, 28.1)	-2.81 (-3.36, -2.26), <0.001
12 months[17]	27.2 (21.8 - 33.4)	29.4 (24.4 - 36.2)	27.7 (27.5, 28.0)	30.4 (29.8, 30.9)	-2.66 (-3.24, -2.07), <0.001
18 months	26.2 (21.2 - 31.6)	27.8 (23.1 - 33.8)	26.2 (26.0, 26.4)	28.3 (27.8, 28.8)	-2.11 (-2.63, -1.58), <0.001
Frequency of feedback	**Twice (n=1,461)**	**Once (n=1,472)**	**Twice (n=1,461)**	**Once (n=1,472)**	**Adj mean difference**

[15] Rates are cumulative from time 0 (date of first feedback sent to GPs (8 November 2019)) until relevant timepoint, reported per 1,000 patient consultations

[16] Adjusted for baseline rate and locality

[17] Primary timepoint

	Observed rates[15]		Model based estimates[13, 16]		
	Median (Q1 - Q3)	**Median (Q1 - Q3)**	**Mean (95% CI)**	**Mean (95% CI)**	**(97.5% CI), p-value**
Baseline	32.4 (27.3 - 38.1)	32.5 (27.2 - 37.9)			
6 months	24.1 (19.0 - 30.6)	23.9 (18.9 - 30.3)	24.9 (24.4, 25.3)	24.7 (24.3, 25.1)	0.14 (-0.04, 0.70), 0.58
12 months	27.4 (21.7 - 33.3)	27.2 (21.9 - 33.5)	27.7 (27.3, 28.4)	27.7 (27.3, 28.1)	0.02 (-0.57, 0.61), 0.93
18 months	26.1 (20.8 - 31.1)	26.3 (21.4 - 31.9)	25.8 (25.4, 26.2)	26.6 (26.2, 27.0)	-0.79 (-1.30, -0.26), 0.001
Visual display	**Enhanced (n=1,475)** **Median (Q1 - Q3)**	**Standard (n=1,458)** **Median (Q1 - Q3)**	**Enhanced (n=1,475)** **Mean (95% CI)**	**Standard (n=1,458)** **Mean (95% CI))**	**Adj mean difference (97.5% CI), p-value**
Baseline	26.1 (21.0 - 31.0)	32.5 (27.1 - 37.9)			
6 months	23.7 (18.6 - 30.3)	24.4 (19.3 - 30.7)	24.4 (24.0, 25.1)	25.2 (24.8, 25.5)	-0.79 (-1.35, -0.24), 0.001
12 months	26.9 (21.3 - 33.0)	27.6 (22.2 - 33.8)	27.4 (26.9, 27.8)	28.1 (27.7, 28.5)	-0.70 (-1.28, -0.11), 0.008
18 months	26.1 (21.0 - 31.1)	26.3 (21.2 - 32.0)	26.0 (25.6, 26.4)	26.4 (25.9, 26.7)	-0.36 (-0.90, 0.17), 0.13

Appendix B – Standard feedback

Australian Government
Department of Health

8 November 2019 Your reference: «reference_»

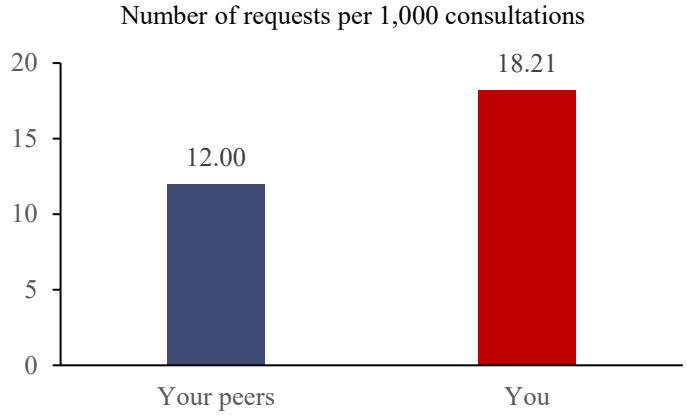
«Title» «First_name» «Last_name»
«Address_Line_1»
«Address_Line_2»
«Suburb» «State» «Postcode»

Dear «Title» «Last_name»

Your musculoskeletal diagnostic imaging request rate is higher than 80% of General Practitioners practicing in a similar geographical region in Australia

You may be aware that overuse of diagnostic imaging services has become a problem in Australia. Most people who present with musculoskeletal pain in the absence of worrying features do not need any imaging as it does not help management. Pain can improve rapidly, for example, around 50% of people who experience an episode of back pain will recover within 2 weeks.

I am writing to you because you request more musculoskeletal diagnostic imaging services than 80% of general practitioners (GPs) practicing in Australia, and your rate on 4 individual items is also higher than 80% of your peers. This rate is displayed below and in the table provided on page 3.



GPs are important stewards in maximising the quality use of diagnostic imaging for the benefit of patients. You can help by reflecting on your requesting data provided in this letter and limiting requests to only those clinical situations where imaging will change your patient's treatment plan and improve their health outcomes. The benefits of tackling this problem include reducing the potential for harm from cumulative exposure to ionising radiation for some investigations, as well as reducing the harm that can come from identifying incidental findings. Not only may this increase patient anxiety, it can also lead to a cascade of further unnecessary tests and treatments.

Resources to support you

Please visit www.health.gov.au/imaging-requests for links to resources that may be helpful.

We welcome your feedback

If you have any questions or feedback, including suggestions on how we can better support you, please contact my team at diagnostic.imaging@health.gov.au, or on 1800 318 207. Please quote your CSE number located on the top right corner of page 1 of this letter when contacting my team.

Yours sincerely

Chief Medical Officer

Your diagnostic imaging requests between 1 January 2018 and 31 December 2018

The table below shows the selected musculoskeletal diagnostic imaging services that were rendered as a result of your imaging requests.

Imaging type	Number you requested	Your requesting rate per 1,000 consults	Requesting rate of your GP peers per 1,000 consults
Low back CT	21	3.51	1.19
Low back x-ray	0	0.00	0.53
Neck CT	13	2.17	0.29
Neck x-ray	1	0.17	0.24
Neck MRI	0	0.00	0.22
Shoulder x-ray	14	2.34	1.48
Shoulder ultrasound	33	5.51	2.67
Hip x-ray	0	0.00	1.48
Hip ultrasound	2	0.33	1.35
Knee x-ray	6	1.00	0.31
Ankle/hind foot ultrasound	19	3.17	0.66
Total	109	18.21	12.00
Number of consultations	5987	**Your overall requesting percentile**	80

How did you calculate my request rate?

We calculated your request rate based on the number of musculoskeletal services (listed above) that you requested for your patients in 2018. We have only included those requests that led to a Medicare Benefits Scheme (MBS) service being rendered by a radiologist.

We are unable to determine the clinical reason for your diagnostic imaging requests from MBS data, however your rate is higher than 80% of your GP peers. While there may be a reason for your high imaging rate, we encourage you to reflect and reduce where clinically indicated and appropriate.

How did you calculate my percentile ranking?

Your percentile ranking was calculated by comparing your request rate to that of other GPs practicing in a similar geographical location in Australia.[18]

How did you account for varying patient loads or number of days worked?

The rates in the table are presented as a proportion of the number of consultations that you rendered in 2018 to account for varying patient loads or days worked throughout the year.

[18] Based on the Modified Monash Model. See our resource page for more information.

Appendix C – Enhanced feedback

Australian Government

Department of Health

8 November 2019 Your reference: «reference_»

«Title» «First_name» «Last_name»
«Address_Line_1»
«Address_Line_2»
«Suburb» «State» «Postcode»

Dear «Title» «Last_name»

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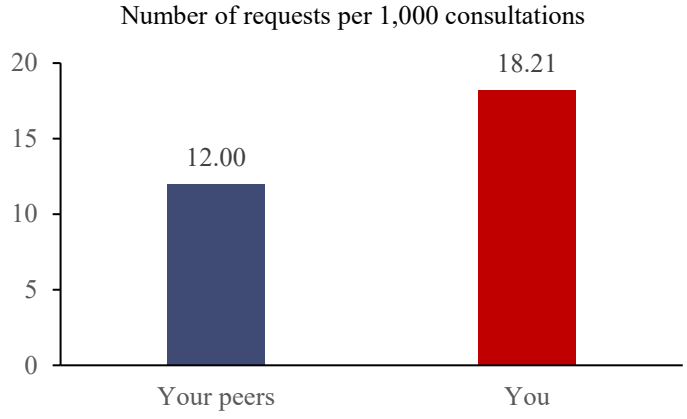

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Resources to support you

Please visit www.health.gov.au/diagnosticimaging for links to resources that may be helpful.

We welcome your feedback

If you have any questions or feedback, including suggestions on how we can better support you, please contact my team at diagnostic.imaging@health.gov.au, or on 1800 318 208. Please quote your CSE number located on the top right corner of page 1 of this letter when contacting my team.

Yours sincerely

Chief Medical Officer

Your diagnostic imaging requests between 1 January 2018 and 31 December 2018

The table below shows the selected musculoskeletal diagnostic imaging services that were rendered as a result of your imaging requests. The specific imaging areas where your rate is higher than 80% of your peers is shaded below.

Imaging type	Number you requested	Your requesting rate per 1,000 consults	Requesting rate of your GP peers per 1,000 consults
Low back CT	21	3.51	1.19
Low back x-ray	0	0.00	0.53
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Neck x-ray	1	0.17	0.24
Neck MRI	0	0.00	0.22
Shoulder x-ray	14	2.34	1.48
Shoulder ultrasound	33	5.51	2.67
Hip x-ray	0	0.00	1.48
Hip ultrasound	2	0.33	1.35
Knee x-ray	6	1.00	0.31
Ankle/hind foot ultrasound	19	3.17	0.66
Total	109	18.21	12.00
Number of consultations	5987	**Your overall requesting percentile**	80

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How did you calculate my percentile ranking?

Your percentile ranking was calculated by comparing your request rate to that of other GPs practicing in a similar geographical location in Australia.[19]

How did you account for varying patient loads or number of days worked?

The rates in the table are presented as a proportion of the number of consultations that you rendered in 2018 to account for varying patient loads or days worked throughout the year.

[19] Based on the Modified Monash Model. See our resource page for more information.

Appendix D – Standard twice

Australian Government

Department of Health

8 November 2019 Your reference: «reference_»

«Title» «First_name» «Last_name»
«Address_Line_1»
«Address_Line_2»
«Suburb» «State» «Postcode»

Dear «Title» «Last_name»

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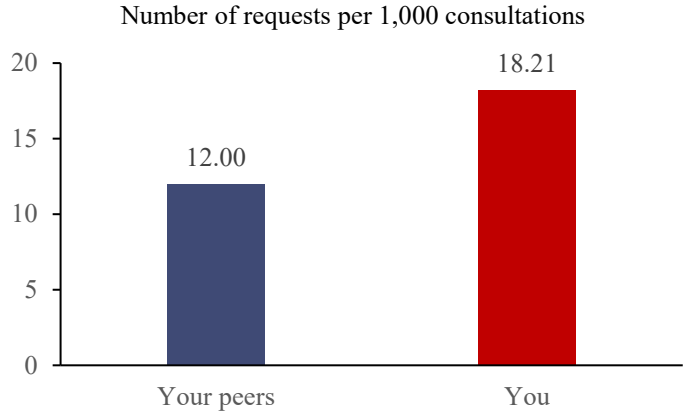

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I will send you another letter in 9-12 months with updated information on your diagnostic imaging. I hope you will find it useful to see how you compare to your peers at that time.

Resources to support you

Please visit www.health.gov.au/diagnosticimaging for links to resources that may be helpful.

We welcome your feedback

If you have any questions or feedback, including suggestions on how we can better support you, please contact my team at diagnostic.imaging@health.gov.au, or on 1800 318 209. Please quote your CSE number located on the top right corner of page 1 of this letter when contacting my team.

Yours sincerely

Chief Medical Officer

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Shoulder x-ray	14	2.34	1.48
Shoulder ultrasound	33	5.51	2.67
Hip x-ray	0	0.00	1.48
Hip ultrasound	2	0.33	1.35
Knee x-ray	6	1.00	0.31
Ankle/hind foot ultrasound	19	3.17	0.66
Total	109	18.21	12.00
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How did you calculate my percentile ranking?

Your percentile ranking was calculated by comparing your request rate to that of other GPs practicing in a similar geographical location in Australia.[20]

How did you account for varying patient loads or number of days worked?

The rates in the table are presented as a proportion of the number of consultations that you rendered in 2018 to account for varying patient loads or days worked throughout the year.

[20] Based on the Modified Monash Model. See our resource page for more information.

Australian Government

Department of Health

9 November 2020 Your reference: «reference_»

«Title» «First_name» «Last_name»
«Address_Line_1»
«Address_Line_2»
«Suburb» «State» «Postcode»

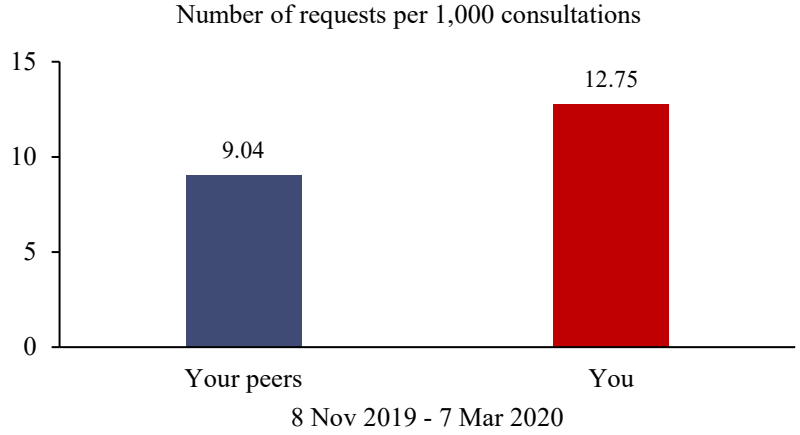
Dear «Title» «Last_name»

GPs are important stewards in maximising the quality use of diagnostic imaging for the benefit of patients. You can help by reflecting on your requesting data provided in this letter and limiting requests to only those clinical situations where imaging has the potential to change your patient's treatment plan and improve their health outcomes.

Your musculoskeletal diagnostic imaging request rate is at the 87th percentile of General Practitioners practicing in a similar geographical region in Australia

On 8 November 2019, Dr Brendan Murphy sent you a letter that outlined your musculoskeletal diagnostic imaging request rate compared to your General Practitioner (GP) peers in Australia during 2018. At that time your request rate was at the **95th percentile** of your GP peers across the imaging items identified. Dr Murphy indicated in his last letter that you would receive an update on your diagnostic imaging requests.

Between 8 November 2019 and 7 March 2020, your musculoskeletal diagnostic imaging request rate was at the **87th percentile** of your GP peers. This rate is displayed below and in the table provided on page 3.



We recognise the COVID-19 pandemic has had a significant impact on the healthcare system, including on diagnostic imaging requesting. This letter only includes information up until 7 March 2020, when the data shows widespread changes in GP requesting rates.

The benefits of tackling this problem include:

- Reducing the potential for harm from cumulative exposure to ionising radiation for some investigations.
- Reducing the harm that can come from identifying incidental findings, which may increase patient anxiety and lead to further unnecessary tests and treatments.
-

Resources to support you

Please visit www.health.gov.au/imaging-requests for resources for patients and medical professionals and opportunities for Continuing Professional Development (CPD).

We welcome your feedback

If you have any questions or feedback, including suggestions on how we can better support you, please contact my team at diagnostic.imaging@health.gov.au. Please quote your CSE number located on the top right corner of page 1 of this letter when contacting my team.

I appreciate your time in considering the information in this letter and your efforts to optimise the use of musculoskeletal diagnostic imaging in line with best practice.

Yours sincerely

Chief Medical Officer

Your diagnostic imaging requests during 2018 and from 8 Nov 2019 to 7 March 2020

The table below shows the selected musculoskeletal diagnostic imaging services that you requested in 2018 compared to other GPs, and the requesting rates from 8 November 2019 to 7 March 2020.

Imaging type	1 Jan 2018 to 31 Dec 2018		8 Nov 2019 to 7 March 2020	
	Requesting rate per 1,000 consults		Requesting rate per 1,000 consults	
	You	Your GP peers	You	Your GP peers
Low back CT	3.51	1.50	1.53	1.11
Low back x-ray	0.00	0.78	0.00	0.52
Neck CT	1.67	0.35	1.19	0.25
Neck x-ray	1.00	0.42	0.17	0.15
Neck MRI	0.00	0.22	0.00	0.22
Shoulder x-ray	1.34	1.48	2.21	1.38
Shoulder ultrasound	5.52	2.67	4.42	1.99
Hip x-ray	0.83	1.48	0.68	1.46
Hip ultrasound	0.33	1.35	0.34	1.24
Knee x-ray	1.00	0.31	0.51	0.19
Ankle/hind foot ultrasound	3.17	0.66	1.70	0.53
Total	18.35	11.22	12.75	9.04
Number of consultations	5980		5876	
Your overall requesting percentile	**95**		**87**	

Why am I receiving diagnostic imaging requesting data?

You are receiving this information because in 2018 you requested more musculoskeletal diagnostic imaging services than 80% of GPs practicing in Australia. This letter provides updated information on your requesting rate from 8 November 2019 to 7 March 2020. Your overall requesting percentile for this period appears in the final row of the table above.

How did you calculate my request rate?

We calculated your request rate based on the number of musculoskeletal services (listed above) that you requested for your patients in the specified timeframes. We have only included those requests that led to a Medicare Benefits Scheme (MBS) service being rendered by a radiologist.

We are unable to determine the clinical reason for your diagnostic imaging requests from MBS data. This information is provided to help you review the appropriateness of your requesting pattern within your practice context and reduce requesting where clinically indicated.

How did you calculate my percentile ranking?

Your percentile ranking was calculated by comparing your request rate to that of other GPs practicing in a similar geographical location in Australia.[21]

How did you account for varying patient loads or number of days worked?

The rates in the table are presented as a proportion of the number of consultations that you rendered in the specified timeframes to account for varying patient loads or days worked throughout the year.

[21] Based on the Modified Monash Model. Please visit www.health.gov.au/imaging-requests for more information.

Appendix E – Enhanced twice

Australian Government
Department of Health

8 November 2019 Your reference: «reference_»

«Title» «First_name» «Last_name»
«Address_Line_1»
«Address_Line_2»
«Suburb» «State» «Postcode»

Dear «Title» «Last_name»

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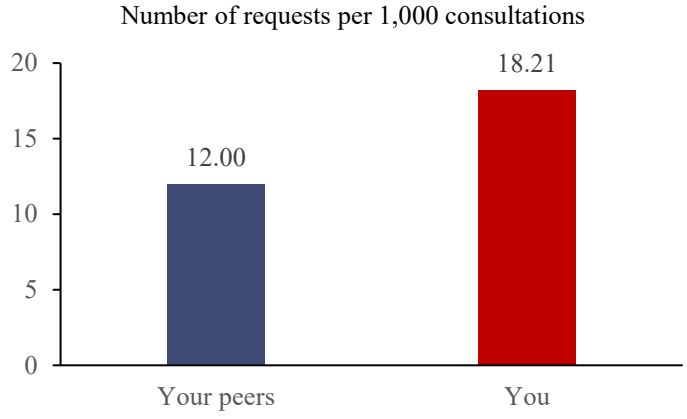

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Resources to support you

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Chief Medical Officer

Your diagnostic imaging requests between 1 January 2018 and 31 December 2018

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Australian Government

Department of Health

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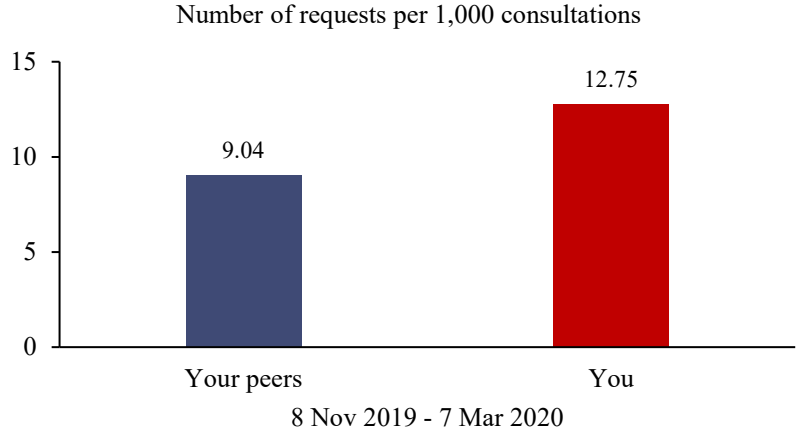

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We welcome your feedback

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Yours sincerely

Chief Medical Officer

Your diagnostic imaging requests during 2018 and from 8 Nov 2019 to 7 March 2020

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The imaging types where your rate is higher than 80% of your peers are highlighted below.

Imaging type	1 Jan 2018 to 31 Dec 2018		8 Nov 2019 to 7 March 2020	
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	You	Your GP peers	You	Your GP peers
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Low back x-ray	0.00	0.78	0.00	0.52
Neck CT	1.67	0.35	1.19	0.25
Neck x-ray	1.00	0.42	0.17	0.15
Neck MRI	0.00	0.22	0.00	0.22
Shoulder x-ray	1.34	1.48	2.21	1.38
Shoulder ultrasound	5.52	2.67	4.42	1.99
Hip x-ray	0.83	1.48	0.68	1.46
Hip ultrasound	0.33	1.35	0.34	1.24
Knee x-ray	1.00	0.31	0.51	0.19
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We are unable to determine the clinical reason for your diagnostic imaging requests from MBS data. This information is provided to help you review the appropriateness of your requesting pattern within your practice context and reduce requesting where clinically indicated.

How did you calculate my percentile ranking?

Your percentile ranking was calculated by comparing your request rate to that of other GPs practicing in a similar geographical location in Australia.[23]

How did you account for varying patient loads or number of days worked?

The rates in the table are presented as a proportion of the number of consultations that you rendered in the specified timeframes to account for varying patient loads or days worked throughout the year.

[23] Based on the Modified Monash Model. Please visit www.health.gov.au/imaging-requests for more information.

Appendix F – Outcomes for individual diagnostic imaging tests

	Observed rate[24]		Model based estimates[22, 25]		
	Intervention (n=2,933) Median (Q1 - Q3)	Control (n=727) Median (Q1 - Q3)	Intervention (n=2,933) Mean (95% CI)	Control (n=727) Mean (95% CI)	Adj mean difference (95% CI), p-value
Lumbosacral spine					
X-ray					
Baseline	1.6 (0.7 - 2.8)	1.6 (0.7 - 1.7)			
6 months	1.1 (0.3 - 2.1)	1.1 (0.4 - 2.4)	1.22 (1.19, 1.25)	1.32 (1.26, 1.38)	-0.10 (-0.17, -0.03), 0.003
12 months	1.2 (0.5 - 2.3)	1.2 (0.5 - 2.3)	1.41 (1.37, 1.44)	1.47 (1.40, 1.54)	-0.06 (-0.14, 0.02), 0.13
18 months	1.2 (0.5 - 2.2)	1.2 (0.6 - 2.4)	1.45 (1.42, 1.49)	1.50 (1.43, 1.57)	-0.05 (-0.13, 0.03), 0.19
CT					
Baseline	1.6 (0.7 - 2.8)	3.6 (2.3 - 5.2)			
6 months	2.4 (1.3 - 4.1)	3.1 (1.8 - 4.6)	2.52 (2.47, 2.56)	2.99 (2.90, 3.09)	-0.47 (-0.58, -0.37), <0.001
12 months	2.9 (1.7 - 4.5)	3.6 (2.1 - 5.0)	3.01 (2.96, 3.06)	3.46 (3.35, 3.56)	-0.45 (-0.56, -0.33), <0.001
18 months	3.1 (1.8 - 4.6)	3.7 (2.4 - 5.1)	3.11 (3.06, 3.16	3.65 (3.55, 3.76)	-0.54 (-0.66, -0.42), <0.001
Shoulder					
X-ray					
Baseline	4.2 (2.8 - 5.7)	4.2 (2.8 - 5.6)			

[24] The rate of imaging requests for each GP was calculated as the total number of diagnostic imaging requests from baseline to the end of the follow-up period (i.e., 6, 12, and 18 months) divided by the total number of consultations over the corresponding period, reported per 1,000 patient consultations

[25] Adjusted for baseline rate and locality

	Observed rate[24]		Model based estimates[22, 25]		
6 months	2.9 (1.7 - 4.5)	3.3 (2.0 - 4.7)	2.84 (2.80, 2.88)	3.22 (3.13, 3.32)	-0.38 (-0.49, -0.27), <0.001
12 months	3.5 (2.5 - 4.9)	3.8 (2.5 - 5.1)	3.38 (3.33, 3.43)	3.71 (3.60, 3.82)	-0.33 (-0.44, -0.22), <0.001
18 months	3.5 (2.3 - 4.8)	3.8 (2.6 - 5.0)	3.41 (3.36, 3.46)	3.74 (3.63, 3.85)	-0.33 (-0.45, -0.21), <0.001
Ultrasound					
Baseline	5.1 (3.9 - 6.5)	5.2 (4.1 - 6.5)			
6 months	3.8 (2.5 - 5.3)	4.2 (2.9 - 5.6)	3.62 (3.58, 3.65)	3.99 (3.92, 4.07)	-0.38 (-0.46, -0.29), <0.001
12 months	4.4 (3.2 - 5.8)	4.8 (3.5 - 6.2)	4.27 (4.23, 4.31)	4.61 (4.53, 4.69)	-0.35 (-0.43, -0.26), <0.001
18 months	4.5 (3.4 - 5.7)	4.8 (3.6 - 6.1)	4.31 (4.27, 4.35)	4.65 (4.57, 4.73)	-0.34 (-0.42, -0.25), <0.001
Cervical spine					
X-ray					
Baseline	0.8 (0.3 - 1.6)	0.8 (0.3 - 1.5)			
6 months	0.5 (0.0 - 1.1)	0.5 (0.0 - 1.3)	0.62 (0.61, 0.64)	0.69 (0.66, 0.73)	-0.07 (-0.11, -0.03), <0.001
12 months	0.6 (0.2 - 1.2)	0.5 (0.2 - 1.4)	0.74 (0.72, 0.76)	0.77 (0.74, 0.81)	-0.03 (-0.07, 0.01), 0.16
18 months	0.6 (0.2 - 1.2)	0.6 (0.2 - 1.3)	0.76 (0.74, 0.78)	0.76 (0.73, 0.80)	-0.003 (-0.05, 0.04), 0.87
CT					
Baseline	0.9 (0.4 - 1.7)	0.9 (0.4 - 1.8)			
6 months	0.6 (0.0 - 1.3)	0.7 (0.0 - 1.6)	0.72 (0.70, 0.74)	0.86 (0.81, 0.90)	-0.14 (-0.18, -0.09), <0.001
12 months	0.7 (0.3 - 1.4)	0.9 (0.3 - 1.7)	0.89 (0.87, 0.91)	1.02 (0.96, 1.07)	-0.12 (-0.17, -0.07), <0.001
18 months	0.8 (0.3 - 1.4)	0.9 (0.3 - 1.7)	0.93 (0.90, 0.95)	1.05 (0.99, 1.10)	-0.12 (-0.18, -0.06), <0.001

	Observed rate[24]		Model based estimates[22, 25]		
MRI					
Baseline	0.4 (0.0 - 1.2)	0.5 (0.0 - 1.3)			
6 months	0.3 (0.0 - 0.9)	0.4 (0.0 - 1.1)	0.50 (0.49, 0.52)	0.58 (0.55, 0.61)	-0.08 (-0.11, -0.04), <0.001
12 months	0.4 (0.0, 1.0)	0.5 (0.0 - 1.2)	0.62 (0.60, 0.64)	0.67 (0.63, 0.71)	-0.05 (-0.09, -0.0003), 0.05
18 months	0.4 (0.1, 1.0)	0.5 (0.1 - 1.2)	0.65 (0.63, 0.67)	0.70 (0.66, 0.74)	-0.06 (-0.10, -0.01), 0.01
Knee					
X-ray					
Baseline	5.2 (3.8 - 6.7)	5.0 (3.7 - 6.6)			
6 months	3.8 (2.5 - 5.4)	4.2 (2.8 - 5.7)	3.69 (3.64, 3.74)	3.98 (3.87, 4.10)	-0.29 (-0.42, -0.17), <0.001
12 months	4.4 (3.0 - 5.7)	4.6 (3.3 - 5.9)	4.21 (4.15, 4.26)	4.44 (4.33, 4.57)	-0.24 (-0.36, -0.12), <0.001
18 months	4.5 (3.2 - 5.8)	4.7 (3.5 - 6.0)	4.35 (4.30, 4.40)	4.65 (4.53, 4.77)	-0.30 (-0.43, -0.17), <0.001
Hip					
X-ray					
Baseline	3.9 (2.7 - 5.3)	3.9 (2.7 - 5.4)			
6 months	6.6 (4.4 - 9.2)	7.3 (5.1 - 9.8)	6.54 (6.45, 6.63)	7.19 (7.01, 7.38)	-0.65 (-0.86, -0.45), <0.001
12 months	3.2 (2.2 - 4.5)	3.7 (2.6 - 4.8)	3.25 (3.20, 3.29)	3.60 (3.51, 3.69)	-0.35 (-0.45, -0.25), <0.001
18 months	3.3 (2.3 - 4.5)	3.7 (2.6 - 4.9)	3.34 (3.30, 3.39)	3.68 (3.59, 3.77)	-0.34 (-0.44, -0.24), <0.001
Ultrasound					
Baseline	3.2 (2.0 - 4.5)	3.2 (2.0 - 4.5)			
6 months	2.4 (1.3 - 3.7)	2.6 (1.5 - 4.0)	2.29 (2.26, 2.32)	2.54 (2.47, 2.62)	-0.25 (-0.33, -0.17), <0.001
12 months	2.7 (1.6 - 3.9)	2.9 (1.8 - 4.3)	2.62 (2.58, 2.65)	2.90 (2.82, 2.98)	-0.29 (-0.37, -0.20), <0.001

	Observed rate[24]		Model based estimates[22, 25]		
18 months	1.8 (1.1 - 2.6)	2.0 (1.2 - 2.9)	1.79 (1.77, 1.82)	1.98 (1.93, 2.04)	-0.19 (-0.25, -0.13), <0.001
Ankle					
X-ray[26]					
Baseline	4.0 (2.9 - 5.4)	3.9 (3.0 - 5.4)			
6 months	5.0 (3.5 - 7.2)	5.6 (4.0 - 7.8)	5.16 (5.10, 5.22)	5.80 (5.66, 5.95)	-0.62 (-0.78, -0.46), <0.001
12 months	5.2 (3.8 - 7.1)	5.5 (4.1 - 7.5)	5.37 (5.31, 5.43)	5.98 (5.84, 6.12)	-0.44 (-0.58, -0.29), <0.001
18 months	5.3 (4.0 - 7.1)	5.7 (4.3 - 7.6)	5.56 (5.50, 5.62)	5.80 (5.66, 5.95)	-0.42 (-0.58, -0.27), <0.001
Ultrasound					
Baseline	1.6 (0.9 - 2.6)	1.6 (0.8 - 2.6)			
6 months	1.2 (0.5 - 2.1)	1.3 (0.5 - 2.5)	1.30 (1.28, 1.35)	1.43 (1.38, 1.47)	-0.12 (-0.17, -0.07), <0.001
12 months	1.3 (0.6 - 2.1)	1.4 (0.7 - 2.4)	1.42 (1.40, 1.44)	1.54 (1.50, 1.59)	-0.12 (-0.17, -0.07), <0.001
18 months	1.4 (0.7 - 2.2)	1.4 (0.8 - 2.4)	1.51 (1.48, 1.53)	1.62 (1.57, 1.67)	-0.11 (-0.16, -0.05), <0.001

[26] Ankle X-ray was not targeted by the feedback intervention but was considered to be a potential substitute for ankle/hind foot ultrasound. As such, it was included as a secondary outcome to check for switching.

Appendix G – Bibliography

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