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Dashboards to reduce inappropriate prescribing of metformin and aspirin: A quality assurance programme in a primary care sentinel network

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ABSTRACT

Aims: To pilot two dashboards to monitor prescribing of metformin and aspirin according to the National Institute for Health and Care Excellence (NICE) 'Do-Not-Do' recommendations.
Methods: This quality assurance programme was conducted in twelve general practices of the Oxford-Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) network. We developed dashboards to flag inappropriate prescribing of metformin and aspirin to people with type 2 diabetes mellitus (T2DM). In Phase 1, six practices (Group A) received a dashboard flagging suboptimal metformin prescriptions in people with reduced renal function. The other six practices (Group B) were controls. In Phase 2, Group B were provided a dashboard to flag inappropriate aspirin prescribing and Group A were controls. We used logistic regression to explore associations between dashboard exposure and inappropriate prescribing.
Results: The cohort comprised 5644 individuals (Group A, n = 2656; Group B, n = 2988). Half (51.6%, n = 2991) were prescribed metformin of which 15 (0.5%) were inappropriate (Group A, n = 10; Group B, n = 5). A fifth (17.6%, n = 986) were prescribed aspirin of which 828 (84.0%) were inappropriate. During Phase 1, metformin was stopped in 50% (n = 5) of people in Group A, compared with 20% (n = 1) in the control group (Group B); in Phase 2, the odds ratio of inappropriate aspirin prescribing was significantly lower in practices that received the dashboard versus control (0.44, 95%CI 0.27–0.72).
Conclusions: It was feasible to use a dashboard to flag inappropriate prescribing. Whilst underpowered to report a change in metformin, we demonstrated a reduction in inappropriate aspirin prescribing.

1. Introduction

Effective management of type 2 diabetes (T2DM) can result in polypharmacy due to the increased number of treatment options available for T2DM and its associated comorbidities [1–3]. This may increase the likelihood of inappropriate prescribing with potential for iatrogenic adverse events [4]. It is estimated that around 20% of mainstream clinical prescribing brings no benefit to patients, and that savings of nearly £2 billion could be made through better clinical practice [5].

The National Institute for Health and Care Excellence (NICE) has identified over 800 clinical interventions for potential disinvestment [6]. These 'Do-Not-Do' recommendations from NICE provide a resource for clinicians to reduce inappropriate prescribing and decrease hospital admissions due to adverse events, with the added benefit of monetary savings [7].

Audit and feedback with peer comparison (A&F) is a focused and widely used quality improvement method that could be used to implement 'Do-Not-Do' recommendations, improve patient outcomes and cost savings. Electronic A&F documents the gap between achievement and guidelines using information technol-

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ogy to extract data and make comparisons between individual practices, their peers and evidence-based guidelines [8,9]. Practice dashboards developed for specific quality improvement initiatives for example, can improve practitioner prescription adherence to guidelines [10], which can be implemented via electronic A&F to help to prevent prescribing errors in people with T2DM in primary care [11].

In this quality assurance (QA) programme, we developed two focussed practice dashboards aligned with specific 'Do-Not-Do' recommendations relating to the NICE recommendations for metformin and aspirin prescribing in T2DM [12]. We explored the impact of the dashboards on prescribing behaviour in twelve UK general practices.

1.1. Aim and objectives

The aim of this QA programme was to develop practice dashboards to monitor prescribing of metformin and aspirin according to the NICE 'Do-Not-Do' recommendations for people with T2DM. The objectives were to:

1 Design a dashboard to monitor rates of metformin prescribing according to renal function, using eGFR categories in people with T2DM.
2 Design a dashboard to monitor rates of aspirin prescribing according to presence of cardiovascular disease (CVD) or chronic kidney disease (CKD) in people with T2DM.
3 Explore the effect of each dashboard on inappropriate prescribing of metformin and aspirin.

2. Methods

2.1. Design of the QA programme

We conducted a 'Do-Not-Do' QA programme to develop and test practice dashboards to monitor medication prescribing in people with T2DM across twelve primary care practices in the Oxford-Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) network.

The RCGP RSC is a primary care sentinel network, which comprises over 1700 volunteer practices across England and Wales [13]. It is one of Europe's oldest sentinel networks and has completed over fifty years of continuous influenza monitoring and UK based vaccine effectiveness studies [14]. UK primary care data are routinely collected and are computerised. Coded clinical data are of good quality from 2004 following the introduction of the Quality and Outcomes Framework, a pay-for-performance scheme for chronic disease management [15,16].

2.2. Selected cohort and recruitment of practices

The selected population were people with T2DM registered with one of twelve practices from the Oxford-RCGP RSC network. These practices were recruited to the QA programme via the monthly RCGP RSC newsletter (Appendix). The first six practices that were recruited were allocated to Group A, and the next six practices were allocated to the Group B.

2.3. Dashboard development and implementation

Practices in Group A received a dashboard to monitor their prescribing rates of metformin in patients with T2DM according to renal function using different eGFR categories (<30 ml/minute/1.73 m^2), 30–44, 45–59, ≤60). The numbers of patients with an eGFR <30 or 30–44 (without medication review in the last 12 months) were flagged as these are thresholds to stop

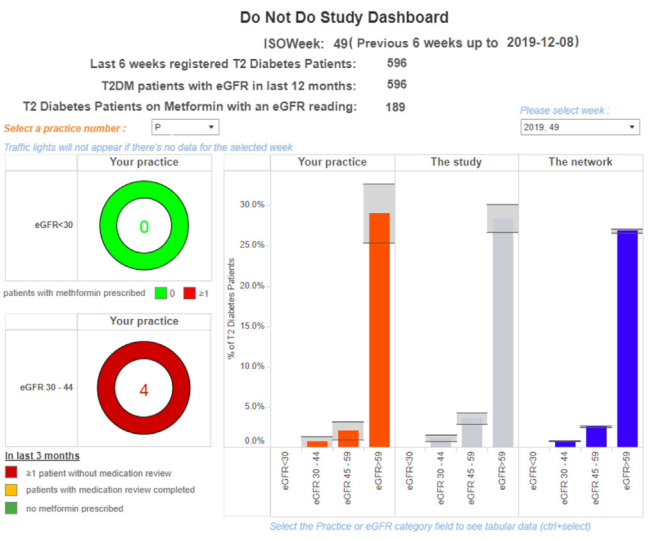

Fig. 1. Metformin dashboard for practices in Group A.

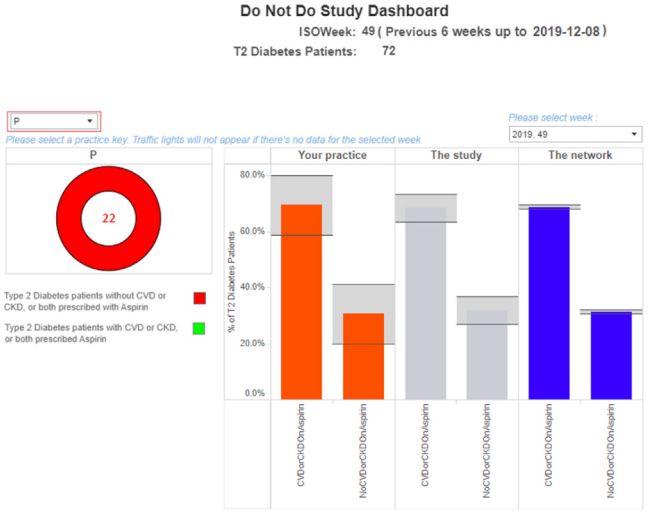

Fig. 2. Aspirin dashboard for practices in Group B.

or adjust dosage as per the NICE 'Do-Not-Do' recommendations (Fig. 1) [12]. Practices in Group B received a dashboard to monitor their prescribing rates of aspirin in patients with T2DM according to presence of CVD or CKD. The dashboard flagged the number of patients without CVD or CKD that were inappropriately prescribed this drug (Fig. 2). The data in each dashboard were presented to allow a practice to monitor their own prescribing, and compare it with aggregated data of the rest of the practices in the QA programme, and the wider RCGP RSC network. Both dashboards were designed to be simple, standard and scalable to display quantitative information visually.

Each dashboard was introduced at two different phases of the programme, each lasting a period of three months. The total duration of the programme was 6 months and ran between April and October 2019. In Phase 1, practices in Group A received the dashboard for metformin prescribing. Group A practices were asked to monitor the dashboard at weekly intervals to coincide with when the dashboard data were updated. In addition, these practices were sent details of the NICE 'Do-Not-Do' recommendations for metformin prescribing as a reminder of the guidelines [17]. Practices in Group B were the comparator group in Phase 1, and did not receive any information. At the completion of Phase 1, the dash-

board for metformin prescribing was deactivated, and Group A were informed that they could stop monitoring it. In Phase 2, the group roles were switched.

In Phase 2, practices in Group B were provided a link to the dashboard for aspirin prescribing, and were asked to monitor the dashboard at least weekly, to keep track of the data as it was updated. As per Phase 1, practices were sent details of the NICE 'Do-Not-Do' recommendations for aspirin prescribing [18]. Practices in Group A were the comparator group, and did not receive any information in Phase 2.

2.4. Exposures

The exposures were the implementation of each practice dashboard: 1) metformin dashboard to monitor rates of prescribing by eGFR category in Phase 1; and 2) aspirin dashboard to monitor rates of prescribing according to presence of CVD or CKD in Phase 2.

2.5. Improvements in care

Improvements in care were defined as changes in prescribing (continued/stopped) for metformin or aspirin in the people inappropriately prescribed these medications at baseline. These changes were explored at the end of each phase of the programme.

2.6. Statistical analysis

Summary statistics were used to describe the baseline characteristics of each cohort. Categorical data were summarised using counts and percentages, and means (with standard deviations) were used to describe continuous data. We reported the percentages of people inappropriately prescribed metformin or aspirin in each group at the different time periods. In our analysis, we updated our definition of inappropriate aspirin prescribing to include people aged ≥70 years due to the increased risk of major haemorrhage in this age group [19,20].

We then selected the people inappropriately prescribed metformin at baseline (eGFR <30 ml/minute/1.73 m^2 or 30–44 and without medication review) and ran multivariable logistic regression models to explore the effect of receiving the metformin dashboard on prescribing at the end of Phase 1. The same analysis was repeated for aspirin prescribing: we selected the people inappropriately prescribed aspirin (without CVD, CKD, or ≥70 years) at baseline and ran a multivariable logistic regression model to explore the effect of receiving the aspirin dashboard on prescribing at the end of Phase 2. Both models were adjusted for age, gender, ethnicity, and socioeconomic status (using Index of Multiple Deprivation [IMD] quintiles). Odds ratios with 95% confidence intervals were reported.

2.7. Ethical considerations

This was a QA programme to remind practices how they were performing against the NICE 'Do-Not-Do' recommendations. The programme did not attempt to influence treatment provided by clinician to patient; this was a decision to be made between them, as per standard practice. Therefore, when the QA programme was assessed using the Health Research Authority (HRA) Medical Research Council (MRC) decision tool, it was deemed to be a clinical audit.

3. Results

The total population comprised 5644 patients with T2DM across the 12 practices in the RCGP RSC network (Group: A 2656; Group B 2988). Age and gender of the patients in each group were similar to each other (Table 1), however Group A included fewer people of black ethnicity. In addition, people in Group A were less deprived than those in Group B.

Table 1
Baseline characteristics of patients in each group.

Characteristic	Group AN = 2656	Group BN = 2988
Age	68.33 ± 13.57	66.20 ± 14.26
Gender (male)	1449 (54.6)	1694 (56.7)
Ethnicity recorded	2367 (89.1)	2458 (82.2)
White	2088 (78.6)	1808 (60.5)
Asian	255 (9.6)	337 (11.3)
Black	11 (0.4)	219 (7.3)
Mixed	9 (0.3)	61 (2.0)
Other	4 (0.2)	33 (1.1)
IMD Quintile recorded	2645 (99.6)	2977 (99.6)
5 (least deprived)	521 (19.6)	695 (23.3)
4	537 (20.2)	467 (15.6)
3	713 (26.8)	563 (18.8)
2	510 (19.2)	711 (23.8)
1 (most deprived)	364 (13.7)	541 (18.1)
eGFR recorded	2496 (94.0)	2776 (92.9)
<30	63 (2.4)	58 (1.9)
30–44	156 (5.9)	147 (4.9)
>45	2277 (85.7)	2571 (86.0)
CKD	538 (20.3)	702 (23.5)
CVD	565 (21.3)	549 (18.4)
Metformin	1394 (52.5)	1517 (50.8)
Aspirin	484 (18.2)	502 (17.4)

Data are presented as n (%) or mean (SD).

Approximately half of the people in each group were prescribed metformin at baseline (Group A: 52.5%; Group B: 50.8%), whilst almost a fifth were prescribed aspirin (Group A: 18.2%; Group B: 17.4%). Of these, only 10 (0.7%) patients in Group A, and 5 patients (0.3%) in Group B were inappropriately prescribed metformin. However, the majority of people were classified as inappropriately prescribed aspirin by NICE as they did not have a diagnosis of CVD or CKD, and/or were ≥70 years old (Group A: 80.4%; Group B: 82.3%).

3.1. Metformin prescribing following dashboard implementation (Phase 1)

Following the implementation of the metformin dashboard, the number of people in Group A inappropriately prescribed metformin halved from 10 to 5 (Table 2). Four of these patients had their medication stopped, whilst one had a medication review. The number of people inappropriately prescribed metformin decreased by one between the end of Phase 1 and the end of Phase 2. For Group B, only one of the five people inappropriately prescribed metformin at the start of the study had their medication stopped following implementation of the dashboard, whilst two patients had a medication review. Due to the very low numbers of people inappropriately prescribed metformin, we were unable to perform a regression analysis to compare changes between Group A and Group B.

3.2. Aspirin prescribing following dashboard implementation (Phase 2)

At baseline, there were 413 people in the exposure group (Group B) and 394 in the comparator group (Group A) inappropriately prescribed aspirin (without CVD or CKD, and/or ≥70 years). Despite the aspirin dashboard only being introduced in Phase 2, the percentage of people inappropriately prescribed aspirin decreased in each group at the end of Phase 1 (Table 3). After implementation of the dashboard, practices in the exposure group (Group B) were less likely to prescribe aspirin (OR 0.44, 95% CI 0.27–0.72) than comparator practices (Group A).

Table 2
Counts of patients incorrectly prescribed Metformin at Baseline, end of Phase 1, and end of Phase 2.

Group		Prescribed metformin		
		BaselineN	End of Phase 1n	End of Phase 2n
A (Exposure)	All prescribed metformin	10	5	4
	<30	3	1	1
	30–40, no medication review	7	4	3
B	All prescribed metformin	5	4	4
	<30	0	0	0
	30–40, no medication review	5	2	2

A = metformin study group; B = aspirin study group.

Table 3
Patients incorrectly prescribed aspirin at Baseline, end of Phase 1, and end of Phase 2.

Study group	Prescribed aspirin		
	BaselineN (%)	End of phase 1n (%)	End of phase 2n (%)
A	394 (100.0)	372 (94.4)	333 (84.5)
B (Exposure)	413 (100.0)	373 (90.3)	291 (70.5)
OR (95% CI)	–	0.57 (0.32–1.04)	0.44 (0.27–0.72)

*Adjusted for age, sex, ethnicity, and IMD quintile.

4. Discussion

In this QA programme we developed dashboards for two widely prescribed medications in people with T2DM. The dashboards were implemented in a small group of RCGP RSC practices, and we explored the effect this had on prescribing for metformin and aspirin according to the NICE 'Do-Not-Do' recommendations. Only a very small number of people were inappropriately prescribed metformin, yet fewer people were inappropriately prescribed the drug after the dashboard was implemented, though this may not have been cause and effect. Whilst for aspirin, we found that approximately 80% prescribed this medication did not have CVD or CKD, or were ≥70 years old, and thus were inappropriately prescribed this medication. We found that the practices exposed to the aspirin dashboard were less likely to be inappropriately prescribed aspirin compared to practices that did not receive the dashboard.

The very low levels of inappropriate prescribing for metformin suggest that for the most part, GPs are following the guidance included in 'Do-Not-Do' recommendations for this drug. We were unable to perform inferential statistics to explore significant changes, so can't claim any impact on prescribing behaviour for this medication. The high levels of aspirin prescribed in people without CVD or CKD however, suggest that in the majority cases, the 'Do-Not-Do' recommendations for this drug were not adhered to. This could be due to GPs following older evidence for this medication, which recommended low dose aspirin in people with diabetes [21]. However, implementation of the dashboard was associated with reductions in inappropriate prescribing of aspirin.

Pragmatic quality initiatives like practice dashboard interventions are becoming increasingly popular to improve the healthcare delivery efficiency, and patient centred care [11,22,23]. This programme builds on our learning from audit-based education, feedback to practice compared to their peers, though this feedback was paper rather than electronic via a dashboard [24]. However, we have demonstrated the feasibility of using dashboards to remind GPs of guidelines and observe their adherence to prescription guidelines. It is also of encouraging that previous studies on dashboard interventions indicate that the impact of this approach on prescribing quality improves [25,26].

The strengths of this programme were that it demonstrated the feasibility of conducting quality improvement initiatives at low cost within the Oxford-RCGP RSC sentinel network, and could provide a platform for wider roll-out. Its limitations were we were underpowered to detect any significant change in metformin prescription, we could have worked with a larger number of practices. Also, collection of prescriptions may not directly measure adherence to medication. Which patients should be prescribed aspirin is more complex than metformin, and that may have been why there were higher levels of inappropriate prescriptions. An additional layer of complexity is that aspirin is also available over the counter, and hence outside the scope of this work. General practices tend to have a single diabetes lead, which may have made communication about the dashboard easier than if promoted for practice-wide use. Finally, the design of the QA programme may have allowed practices in group B (aspirin) to have longer to become familiar with the intervention.

Further research is needed to see if the approach used in this intervention could be replicated on a larger scale, and a network such as the Oxford-RCGP RSC provides a venue to do this. There are clear benefits to avoid aspirin side-effects such as gastrointestinal or intracranial haemorrhage with additional diagnostic, therapeutic and often hospitalisation costs [27–29]. A metformin dashboard may assist in safe prescribing and reduce risk of metformin-associated-lactic acidosis associated a low eGFR [30–32]. The approach may be valuable to look at other treatment areas in diabetes including exploring disparities in prescribing [28].

4.1. Conclusions

These newly developed Do-Not-Do dashboards were associated with an improvement in aspirin prescribing, but underpowered to demonstrate the same for metformin. Whilst we have demonstrated the feasibility of using dashboards to improve prescribing in people with T2DM, its wider application now needs testing in a larger study.

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Authorship contributions

SdeL led the drafting of the manuscript. WH performed the analysis with statistical input from MJ. WH, SS, MM, MF, NM, MJ, FC, FDRH, and KK reviewed the manuscript and study design and contributed to the draft of the final manuscript.

Conflicts of interest

SdeL was awarded a grant for this work from PCDE. The remaining authors have no conflicts of interest to declare related to this article.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.pcd.2021.06.003.

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