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Drug and Therapeutics Bulletin: Medication Safety in Primary Care – from measurement to action

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Key messages

- Harm from medication is an important cause of potentially avoidable morbidity/mortality and should remain a key area for improvement in primary care.
- Prescribing safety indicators (PSI) are a useful tool to describe scenarios in which there is potential inappropriate prescribing and a move to real time feedback on prescribing practice should be supported.
- Implementation of PSI across health systems at scale needs co-ordination and resources to support sustainable behaviour change

Introduction

The World Health Organization (WHO) recognised the burden of harm from medicines as a global patient safety challenge in 2017 with medication errors estimated to cost almost 1% of total global health expenditure ($52 billion USD annually) with preventable drug-related admission to hospital estimated at a median 3.7% (range 1.4-15.4). (1-3) The ageing population with increasing prevalence of polypharmacy and drug-drug interactions are major contributors to the potential for medicine harm. (4,5) The WHO initiative – *Medication Without Harm* – aims to reduce the level of severe, avoidable harm related to medicines by 50% by 2022. (1)

In primary care, medicines are the most commonly used intervention to support disease management with over 1 billion prescriptions dispensed annually across England, equating to approximately 7% of total NHS England spend (in 2018 equivalent to £8.8 billion). (6) Several United Kingdom (UK) population database studies have identified and estimated the significant potential harm arising from primary care prescribing, as an impetus for improvement. (7,8) Four drug groups have been shown to contribute over >50% of the potentially preventable hospital admissions i.e. NSAIDS; antiplatelets; diuretics; anticoagulants. (2)

Multiple approaches have been adopted to identify, quantify and manage the extent of harm arising through routine medicines use. One approach is the assessment of medicine use against explicit measures that identify patients at risk of harm. Such measures are encompassed by a myriad of terms in the literature including – quality / therapeutic / high risk prescribing / prescribing safety indicators. For the purpose of this review we will use the term “prescribing safety indicators (PSI)”, commonly used within the UK setting. We will explore the scope, scale and impact of PSI to drive improvement in medication safety, focused on the UK, and consider how this could evolve in the future.

International evidence base

Internationally much work has been undertaken to develop and apply PSIs to promote safe medicine use and allow continuous measurement of the quality of care within health systems. Most recently, *Fujita et al* published (2018) a systematic review of quality indicators (QI) for responsible use of medicines. This review identified 2431 content validated QI, the majority (94%) of which were process indicators, as classified using the Donabedian framework (structure, process, outcome) and were therapeutically focused on areas of known high risk prescribing i.e. nervous system, anti-infectives and cardiovascular. Although the majority of QI were developed in the USA, Canada and the Netherlands there are many that apply to the NHS, some of which are PSI. (9)

UK evidence base

Design and development of Prescribing Safety Indicators

In the UK there has been a long history of improving the safety of medicines use, supported in part by PSIs. Multiple sets of indicators/measures have been published, varying in complexity and scope, often determined by the availability of health system data. (10,11) Significant efforts have been deployed to provide an evidence base for these measures and engage consensus building programmes with clinicians in their construction. In 2014, *Spencer et al*, undertook a systematic review to identify an updated set of 56 prescribing safety indicators suitable for use in general practice (GP), feasible for adoption using electronic health records (EHR) and subsequently included in the Royal College of General Practitioners patient safety Toolkit. (10,12) In addition, *Dreischulte et al* published a set of 176 medication assessment criteria, of which 124 were categorised as safety assessment criteria. (11)

Such PSI developments continue to be fuelled and enabled through the widespread adoption of electronic prescribing and EHR systems in primary care; access to data from these systems makes it now relatively straightforward to construct PSI and continuously measure prescribing practice at scale. Table 1 presents for each of the home countries resources, comprised of measures for the responsible use of medicines, funded by government. Some of these indicators are publicly available, others restricted to healthcare providers. The resources comprise a broad range of measures, including PSI, and vary in the extent of their specificity to different types of drug and/or disease orientation as defined by *Campbell et al*. (13) The diversity of measures available across the UK may reflect: different health policy and primary care delivery systems; varied data availability to compose measures, and; the level of infrastructure available to support improvement programmes focused on medication safety. The result is an increasing number of measures being generated and available to general practice; the challenge, how best to navigate and deploy these tools within local practice.

In the UK marketplace there are many not-for-profit and commercial products designed to provide real time feedback on prescribing practice using PSIs. In the main these products require integration within the GP clinical computer system to access data and generate alerts which can then be presented to clinicians for action. Some of these products also allow for analysis at the level of practices and primary care organisations for comparison purposes and to stimulate action. Many of the commercial products make strong claims for effectiveness, but few have been formally evaluated. For example, none were included in the most recent 2017 Cochrane review of interventions in primary care aimed at reducing medication errors. (14)

Use of Prescribing Safety Indicators

Major efforts have gone into the design and validation of PSI and their production at scale across primary care systems. Attention is now turning to how to best support the use of these measures sustainably into routine clinical practice to effect change. Building on a strong evidence base capturing more broadly the study of professional practice and changing behaviour to improve the quality of care (15-19) strategies focused on prescribing improvement have demonstrated small (~5%) to moderate (~11-20%) effects. (20) A range of approaches have been deployed including: simple audit and feedback; educational outreach and professional development workshops, and; informatics to support clinical decision making (20). From these studies there is some evidence that multi-component interventions maybe more effective in the short term (up to 12 months) with sustained impact less well studied.

In the last two decades various UK clinical trials centred on PSI have embraced a more systematic approach to the design of interventions, drawing more overtly from behavioural change theories and implementation science. (20-24) In 2011, *Michie et al* developed the behaviour change wheel (BCW) – at its centre a "behaviour system" involving three essential conditions which interact to generate behaviour: capability; opportunity and motivation (commonly termed the COM-B model). Capability includes the knowledge and skills necessary to engage in the behaviour; opportunity are those external factors that prompt or enable the behaviour, and; motivation is the level of intention and energy to perform the behaviour. The BCW comprises of the behaviour system, around which are placed nine intervention functions (persuasion, education, incentivisation, restrictions, environmental restructuring, modelling, enablement, training, coercion) and around these seven policy categories (legislation, guidelines, fiscal measures, environmental/social planning, communication/marketing, service provision, regulation) as potential enablers for the intervention. (25)

In Table 2 we have applied the COM-B model to three UK interventional studies, all demonstrating a positive impact on changing clinicians' prescribing behaviour to some degree, to understand how these designed interventions have attempted to impact behaviour through the lens of the *Michie et al* 'behaviour system'. Interestingly, three BCW intervention functions (education, persuasion, enablement) were found to be

common among the three example studies, which unexpectedly did not include financial incentivisation (Table 2). It is becoming apparent that multi-faceted implementation strategies, covering all the essential conditions necessary for behaviour change outlined by the COM-B framework, are required for an intervention to be effective in changing prescribing behaviours, possibly a reflection of the complex nature of the prescribing decision process. (26,27)

There is evidence that all three of these interventions are scalable. For example, at the time of writing: PINCER (PSI example- patients receiving warfarin for at least 3 months who have not had a recorded check of their international normalised ratio in the previous 12 week) was being rolled out across England through the academic Health Science Network with over 2430 general practices engaged by 1 April 2020; in Scotland the EFIPPS (PSI example – number of people aged >65yrs co-prescribed a NSAID and an ACE inhibitor/angiotensin receptor blocker and a diuretic as a percentatge of all people aged > 65yrs prescribed an ACE inhibitor/angiotensin receptor blocker and a diuretic) measures are incorporated into the National Therapeutic Indicators, and; the DQIP measures (PSI example – aspirin or clopidogrel without gastroprotection in patients taking oral anticoagulants) are available to all GP practices within the Scottish Therapeutic Utility (Table 1).

Looking Forward

The evidence base on minimising harm from medicines is extensive and PSI are a core element of this activity. Though there are a vast array of PSI available, there are probably a limited number of high or extreme risks of harm to patients that are sufficiently common and reliably operationalised as PSI, to enable a focus for feasible scalability. (10) For the future, one challenge will be to build on this foundation to create more holistic patient centric review systems, moving away from single PSI which are often drug or disease focused. An initial step maybe to evolve '*patient specific PSI bundles'* i.e identifying at the individual patient level a range of PSIs, a bundle, to inform a structured medication review. Such an approach may help to address the risk of harm in our aging populations with a rising prevalence of multimorbidity and polypharmacy. It is noteworthy that recently, *Loke et al* (2020) cautioned the readiness of healthcare systems to synthesize clinical data to accurately estimate benefit-harm risk profiling using computerised tools and algorithms. (28)

The generation of PSI, is but one step on the journey to effect change and more recently attention has turned to the complexity of understanding prescribing behaviour – drawing on behavioural and implementation science domain expertise in the design of tools/interventions to support action within clinical practice. This can only be a positive step as the complexity of care and clinical decision making in partnership with patients develops. Positive results are starting to emerge of the impact in investing time in the design of interventions and testing within a clinical trial framework (21-23). However, attention will need to be paid to the transition of interventions

delivered and tested within these clinical trial settings to widespread implementation if the observed benefits are to be realised. The COM-B model could assist in identifying and supporting the context for behavioural change at multiple levels - local, regional, national, international.

Thus far, impact, measured by changing rates of PSIs is a positive start but more work is needed to better understand how this converts into actual harm avoided and in the context of the economic cost to public health systems from these investments. A Cochrane Review in 2017 examining professional, structural and organisational interventions in primary care for reducing medication errors found little or no difference in the number of people admitted to hospital or the number of hospitalisations, emergency department visits, or mortality – suggesting there is still much room for improvement. (14)

In returning to the global call, by WHO, to reduce avoidable harm from medicines by 50% by 2022 the UK should remain as a key player in this endeavour through (1): firstly, continuing to publish the evidence base on the implementation of complex interventions into learning health systems within increasingly diverse multidisciplinary team working, and delivering these at scale within routine care; secondly, providing leadership in efficient navigation of the design and selection of PSI to health systems with limited data systems and resources internationally, and; thirdly, reflecting across the UK on where collegiate leadership, within/across professions and with patients/public could bring efficiency of effort within our health systems and consistency of clinical care across the UK.

Conclusion

The extent of avoidable harm from medicines remains a major public health concern. There is an evolving evidence base of how PSI, embedded within well designed implementation programmes, can change prescribing behaviour and reduce potential inappropriate prescribing. The rapidly evolving plug and play software solutions providing real time feedback on prescribing practice are helpful but there is a need to fully evaluate their impact, both intended and unintended consequences, if these are to be mainstreamed safely across health systems. Furthermore, evidence for actual patient harm avoided remains limited for PSI, and although complex in interpretation, should be a key future focus for learning health systems.

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Table 1: Nationally available Prescribing Safety Indicator resources (supported by government)

Country	Resource / Source (weblink)	Type of indicators *	Timeliness	Geography	Accessibility
Scotland	National Therapeutic Indicators – Scottish Government *(link)*	Quality and safety indicators Type – 1,2	Delayed	Practice-level	Publicly available via website
	Scottish Therapeutic Utility - Scottish Government	Quality and safety indicators Type – 1,2,3,4	Real time	Patient-level	For approved staff within GP practices only
England	ePACT2 dashboards (includes *Medicines Optimisation and Medication Safety dashboards)* - NHS Business Systems Agency (link)	Quality, efficiency and safety indicators Type – 1,2,3	Delayed	Practice-level	Partly publicly available Some areas of website for approved health system staff only
	Open Prescribing (link)	Quality and efficiency indicators Type 1	Delayed	Practice-level	Publicly available via website
Wales	National Prescribing Indicators (link)	Quality and efficiency indicators Type – 1,2,3	Delayed	Health Board level Practice-level	Publicly available website For NHS Wales health system staff only
		Safety indicators Type – 1,2,34	Real time	Patient-level	For approved staff within the GP practices only
Northern Ireland	COMPASS (link)	Quality and safety indicators Type – 1,2,3	Delayed	Practice-level	For approved NHS Northern Ireland health system staff only

*Type of Indicator: 1- drug orientated QI (drug level e.g. ratio of simvastatin to statins) ; 2- Drug orientated (patient level e.g. proportion of patients initiated on angiotensin II receptor blockers (ARBs) who are previously dispensed ACE inhibitors)); 3- disease orientated e.g. proportion of patients with atrial fibrillation receiving anticoagulants ; 4- Patient orientated e.g use of NSAIDs for arthritis in patients >65yrs old who have not tried paracetamol (13)

Table 2 Applying the Capability, Opportunity, Motivation and Behaviour (COM-B) model domains to exemplar prescribing safety indicator intervention studies from the UK

COM-B system elements		EFIPPS (21)	DQIP (20)	PINCER (22)
Study Design		Cluster randomised, controlled study	Cluster randomised, stepped wedge study	Cluster randomised, controlled study
Behavioural Change Wheel Intervention function		Education, Persuasion, Enablement	Education, Fiscal Incentivisation, Persuasion, Enablement	Education, Persuasion, Enablement, Environmental-restructuring
Capability*				
Psychological	• Knowledge (enhance GPs' awareness of hazardous prescribing and the evidence underlying the indicators)	√	√	√
	• Memory (reminders through repeated feedback)	√	√	
	• Behavioural regulations (benchmarking)	√		
Physical	• Skills (all indicators were related to therapeutic areas that are mainly managed in primary care; hence, GPs, pharmacists and other members of the primary care team skilled to do the changes)	√[a]	√	√
Opportunity**				
Social	• Social pressure (persuasion and communication of the intervention to clinicians via authoritative NHS organisations, practice manager or lead GP)	√	√	√
Physical	• Resource (providing clinicians with resources e.g. digital tools, pharmacists to help identify patients at high-risk prescribing)	√	√	√
Motivation***				
Reflective	• Beliefs about capabilities, self-confidence and consequences (GPs might feel less confident changing prescribing in therapeutic areas initiated by specialists e.g. severe mental health)	√		
	• Outcome expectancies (persuade GPs that implementing the intervention will result in better patient care)		√	√
	• Goals (provide GPs with their prescribing rates and neighbourhood practices to benchmarks and audit themselves)	√		
	• Behavioural attitudes (bringing the practice team together to engage, persuade and motivate individual GPs to implement the intervention)		√	√

	• Financial Incentive (provide explicit financial incentive to review patients with high-risk prescribing)		√	
Autonomic	• Reminders (reminder emails sent to practices to review their performance against the proposed indicators)	√	√	

*Capability - Individual person's psychological and physical capacity to engage and perform the desired activity or behaviour (includes having the required necessary knowledge and skills)
** Opportunity - All external factors in person's environment or circumstances that encourage or discourage the desired behaviour (includes time, resource and norms of practice)
*** Motivation - A coherent set of brain process that determines person's displayed personal qualities in a social and work setting (includes habitual processes, emotional responding, analytical decision making and professional confidence)
[a]: one indicator was related to mental health which might not be a therapeutic area that is mainly managed in primary care;
EFIPPS: Data feedback and behavioural change intervention to improve primary care prescribing safety. Groups: *usual care* - emailed educational material with support for searching to identify patients; *usual care plus feedback on practice's high risk prescribing* - sent quarterly on five occasions; *usual care plus feedback incorporating behavioural change component.* Primary Outcome measure: Patient level composite of six prescribing measures relating to high risk use of antipsychotics, non-steroidal anti-inflammatories, and antiplatelets
DQIP: data-driven quality improvement in primary care. Groups: randomised to one of 10 start dates. Intervention with three components: a web-based informatics tool providing weekly feedback of targeted prescribing, prompting review of patients and summarising each patient's relevant risk factors and prescribing; an outreach education visit on targeted prescribing and informatics tool; and a fixed payment of £350 up front and a payment of £15 per patient reviewed. Primary Outcome measure: Composite of nine previously validated measures of high-risk prescribing relating to NSAIDS and antiplatelets
PINCER: a pharmacist-led information technology intervention for medication errors. Groups: *Control* - computer-generated simple feedback for at-risk patients; *PINCER* - pharmacist-led information technology intervention composed of feedback, educational outreach, and dedicated support**.** Primary Outcome measure: proportions of patients at 6 months post intervention with any of three clinically important errors focused on NSAIDs, β blockers; (ACE) inhibitor or loop diuretics