DIGITAL TECHNOLOGY

Managing patients with comorbidities: future models of care

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ABSTRACT

One in four adults in the UK have two or more medical conditions. One in three adults admitted to hospital in the UK have five or more conditions. People with multimorbidity have poorer functional status, quality of life and health outcomes, and are higher users of ambulatory and inpatient care than those without multimorbidity. The entire healthcare system needs to change so that it can provide a better service for patients with multimorbidity. The system of healthcare professional education needs to change also. Clinical decision support has a clear role in the management of patients with multimorbidity. But, until now, clinical decision support tools have offered no support when dealing with patients with comorbidities; they have covered single conditions only. In light of this, BMJ Best Practice recently launched the Comorbidities Manager. This enables healthcare professionals to add a patient's comorbidities to an existing management plan and get a tailored plan instantly. This article outlines the importance of taking into account comorbidities when managing patients and the role that the BMJ Comorbidities Manager can play in this regard.

KEYWORDS: clinical decision support, comorbidities, GIRFT

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Introduction

One in four adults in the UK have two or more medical conditions.[1] One in three adults admitted to hospital in the UK have five or more conditions.[1] The proportion of adults with multiple health conditions (or multimorbidity) is rising rapidly: 10 years ago, one in 10 patients admitted to hospital as an emergency had five or more conditions. People with multimorbidity have poorer functional status, quality of life and health outcomes, and are higher users of ambulatory and inpatient care than those without multimorbidity. They also have a higher mortality rate. The population in the UK and throughout the world is currently ageing, and older people have higher rates of multimorbidity. However, multimorbidity is not confined to older people. Thirty per cent of people with four or more conditions are under 65 years old.[1] Being poor is another risk factor for having multiple illnesses, and poor people tend to develop multimorbidity earlier in life.[2] This all poses a problem for patients, healthcare professionals and health systems. When comorbidities aren't taken into account, patients get suboptimal care leading to worse clinical outcomes. Comorbidities are also associated with longer lengths of stay in hospital.

The entire healthcare system needs to change so that it can provide a better service for patients with multimorbidity. The structure and processes of care will need to change, and the culture will need to be transformed so that it becomes more patient-centric. The system of healthcare professional education needs to change also. According to Whitty *et al*, 'Training from medical school onwards, clinical teams, and clinical guidelines, however, all tend to be organised along single disease or single organ lines.'[3] Similarly, Barnett *et al* state that, 'Existing approaches focusing on patients with only one disease dominate most medical education'.[4] There is evidence that medical students feel unprepared for clinical practice generally and for the management of patients with comorbidities specifically. The report *How prepared are UK medical graduates for practice?* was commissioned by the General Medical Council: it showed that foundation year doctors 'felt unprepared for complex cases (e.g., confused patients, co-morbidity), often feeling uncertain. Some participants reported being better prepared for making diagnoses than the patient management.'[5] Participants in this study 'talked a lot about the growing issue of clinical complexity in terms of comorbidity and the need for [foundation year-1 doctors] to avoid thinking in silos.'[5] So, there is a real need to improve undergraduate and postgraduate education in this area for doctors and for other healthcare professionals.

Clinical decision support is 'any electronic … system designed to aid directly in clinical decision making, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations that are then presented to clinicians for consideration.'[6] Clinical decision support has a clear

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role in the management of patients with multimorbidity and polypharmacy. But, until now, clinical decision support tools have offered no support when dealing with patients with comorbidities; they have covered single conditions only. In light of this, BMJ Best Practice recently launched a new tool: the Comorbidities Manager (https://bestpractice.bmj.com/info/comorbidities). This enables doctors and other healthcare professionals to add a patient's comorbidities to an existing management plan and get a tailored plan instantly. It supports healthcare professionals in treating the whole patient when managing acute conditions. The BMJ Comorbidities Manager is a digital tool aimed at all healthcare professionals working in secondary care.

Herein, we outline how common comorbidities can interact with other conditions and the risks associated with such interactions. We also offer guidance on how to manage patients with multiple illnesses and how to avoid common pitfalls that occur when comorbidities are neglected or overlooked. We have concentrated mainly on high-prevalence chronic non-communicable disease comorbidities that can affect physical or mental health.

Diabetes

The prevalence of diabetes in the inpatient population has grown from 14.5 % in 2010 to 18.1% in 2019 and is three times that in the general population (National Diabetes Inpatient Audit (NaDIA), 2019).[7] By 2030, it is predicted that 25%–30% of inpatients will have diabetes. Systems need to be in place to cope with this increase, particularly as diabetes is associated with increased morbidity and mortality, and increased length of stay and readmissions. Although these adverse outcomes are partly due to comorbidities (such as obesity, heart disease and renal disease), poor diabetes management is a major factor. Poor care can result in life threatening hypoglycaemia, diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic syndrome (HHS) as well as hospital-acquired foot lesions that may result in amputation. It is concerning that approximately one in 25 people with type 1 diabetes develops DKA in hospital due to mismanagement; much more frequently than when they care for themselves in the community, and one in five of those with diabetes in hospital will experience an episode of hypoglycaemia.[7] Even more concerning, one in four people with type 1 diabetes has such a severe hypoglycaemic episode that they require rescue treatment with either intravenous glucose or glucagon. Again, this is considerably more frequent than when they manage their own diabetes. In this context, it is not surprising that insulin therapy is one of the three most common medications where errors in prescription and/or administration may result in death.[8] By far, the vast majority of people with diabetes (93%) are admitted for non-diabetes-related reasons (eg elective surgery and acute illnesses such as pneumonia, fractures, cardiac events etc) and, as such, will be cared for by non-specialist teams, at least during their initial management.[7]

Diabetes inpatient specialist teams are a limited resource and, as such, focus on the management of the more complex patients. Even in these patients, the diabetes teams will not be present out of hours and at weekends. It is, therefore, essential that all doctors and nurses are capable of providing basic diabetes care to prevent diabetes-related harms. Furthermore, they need to be aware of specific diabetes-related issues that may complicate the condition they are managing. The Comorbidities Manager addresses both of these areas of diabetes care. The conditions sepsis and hip fracture are good examples of where the tool can be helpful when diabetes is a comorbidity.

For people with diabetes presenting with sepsis, the tool advises a foot examination to be undertaken on admission, as foot infection and/or osteomyelitis may be the original source of infection. It is not uncommon to encounter patients with systemic infection in whom bandages have not been removed for several days. Delay in its detection may result in worsening foot sepsis and tissue necrosis. The tool also gives advice on glycaemic management, such as excluding hypoglycaemia, DKA and HHS. It reminds staff that insulin should never be stopped in a person with type 1 diabetes as insulin deficiency can result in DKA. It recommends stopping sodium-glucose linked transporter-2 inhibitors, as continuing these during illness can precipitate DKA. The indications for withholding metformin are given, as is advice on when to use a variable rate intravenous insulin infusion (VRIII). It also links to a section on the important area of managing glycaemia when glucocorticosteroids are used.

Another example where the Comorbidities Manager is helpful is for a patient admitted with a hip fracture. The tool advises early involvement of the orthogeriatrician with a frail elderly patient. For a person with diabetes, it recommends a foot examination to detect loss of protective foot sensation.[9]

The tool also describes a quick and simple method to do this. As with all the conditions where diabetes is a comorbidity, it recommends excluding hypoglycaemia, DKA and HHS, any of which may be relevant where a fall led to the fracture. As with the previous example, the need to continue insulin in people with type 1 diabetes is stressed. Again, there is advice on which drugs to stop. There is also advice on the indications for a VRIII with particular relevance to those being fasted in preparation for surgery. The frequency of glucose monitoring on the ward, in theatre and in recovery as well as target glucose levels follow the Centre for Perioperative Care's guidance for perioperative diabetes care.[10]

In summary, with the increasing prevalence of people with diabetes in hospital, many with multiple comorbidities, the Comorbidities Manager is an important resource for non-specialists to call upon to help support them in delivering safe diabetes care.

Geriatric medicine

A geriatrician's clinical workload has long been centred on the art of balancing the shifting priorities of multiple comorbidities when presented with a patient with a destabilising medical event. Translating that clinical acumen into the realm of interactive digital guidelines is a great challenge. This is because grafting an understanding of how the presence of one or more comorbidities affects a clinical pathway in an iterative fashion is more akin to a logarithmic change in knowledge transfer, rather than a scalar one. However, the Comorbidities Manager has recently taken on this task. Utilising the 'Select comorbidities' function of the tool has allowed one-size-fits-all guidelines to be moulded into a much more person-centred approach. There are many advantages to this approach, but a number are especially worth highlighting from the perspective of geriatric medicine.

The first is the ability to select dementia as a comorbidity. In daily hospital medical practice, an ever-increasing percentage of patients can be expected to have dementia as a comorbidity, typically stated to be around one in four adult inpatients.[11]

However, the majority of this patient group are admitted for reasons other than their dementia.[12] This demonstrates a clear requirement for guidance on typical medical causes for admission (such as pneumonia, myocardial infarction or hip fracture) to reflect how approaches in treatment need to be tailored to patients with dementia. This is especially so in areas of consent and capacity.

The second aspect of focus is around disease state interactions and, more specifically, around the interactions of medicines commonly expected on a prescription list due to known comorbidities. Reviewing a patient's current prescription list while simultaneously considering new prescriptions for the cause of admission occupies significant amounts of thinking on a typical geriatric medicine post-take ward round. Codifying those expected interactions and flagging them through the Comorbidities Manager replicates a large aspect of the essential teaching we carry out for our trainees at all levels. This will save time and reinforce important teaching. It also reduces the likelihood of iatrogenic harm from polypharmacy, using our expert knowledge of an issue that is challenging to capture in evidential studies.[13]

Thirdly, the Comorbidities Manager is a good prompt and signposting tool for junior colleagues. Many older people present to hospital with delirium and falls because of an acute illness, which is compounded by their underlying multiple chronic conditions. Addressing the presenting conditions and being mindful of the other multiple conditions is essentially the work of the geriatrician. A geriatrician cannot see all older people admitted to hospital; the tool is designed to help junior doctors think and act like a geriatrician.

Fourthly and lastly, the comorbidities in the tool also happen to be the most common chronic conditions found in older people. These include hypertension, coronary artery disease, heart failure, chronic obstructive pulmonary disease (COPD), dementia, chronic kidney disease, diabetes mellitus, stroke, depression and asthma.

Geriatric medicine is about providing comprehensive care that is focused on individual patients and what matters to them.[14] The new tool should support all doctors in providing such care.

Respiratory

One in five people in the UK have had a diagnosis of COPD or asthma, and over 700,000 admissions are due to respiratory disease every year. COPD accounts for 10% of all medical admissions.[15]

It is, therefore, essential that doctors in training and advanced clinical practitioners are equipped to manage acute exacerbations of these diseases whatever the cause of the hospital admission, understand where usual care may need to be altered due to co-existing airways disease (either COPD or asthma) and are aware of potential harmful medication interactions. The Comorbidities Manager, therefore, focuses on COPD and asthma with particular 'alerts' for doctors where their practice might need altering.

A long-standing challenge is in ensuring target oxygen saturations. Supplemental oxygen prescription is tailored for patients with COPD where potential deterioration can be caused if too high target saturations are used to prescribe supplemental oxygen.[16]

Electronic patient records and prescriptions have improved oxygen prescribing and often have prompts to select appropriate target saturations. The Comorbidities Manager flags this potential problem when COPD is selected as a 'comorbidity' and provides advice on which target saturations to prescribe. Sensible use of arterial blood gas monitoring is also highlighted.[16]

Cardiac and respiratory disease commonly occur together due to joint aetiological risk factors, and acute cardiac pathology is not uncommon with COPD or asthma.[17] It is essential that cardiac medication is not sub-optimally prescribed due to often unfounded concerns around inducing acute bronchospasm, particularly in people with COPD. The Comorbidities Manager flags the evidence to support safe prescribing and also when to request specialist help.

Acute asthma can be life-threatening, and patients can deteriorate extremely quickly, especially if early signs are not appreciated. The Comorbidities Manager flags what to do in an emergency but, most importantly, when to urgently request senior and specialist support.

Related to this is exacerbation prevention while people with COPD and asthma are in hospital with unrelated problems. All patients with COPD and asthma will be prescribed inhaled medication but this can commonly be overlooked by non-specialist prescribers. The Comorbidities Manager provides a useful prompt to prescribe usual inhaled medication to prevent exacerbations from occurring. It is essential that prescriptions are accurate and should include medication and device (often a trade name is needed), dose and frequency, and route usually either via a metered dose inhaler (with aerochamber) or dry powder inhaler.

Finally, the Comorbidities Manager highlights nicotine dependence as a comorbidity and provides advice to discuss tobacco smoking with all current smokers, prescribe nicotine replacement therapy during admission to avoid withdrawal symptoms, and refer to the local stop smoking service.

Cardiology

Cardiovascular conditions are highly prevalent in patients admitted to hospital, and among those above the age of 65 years seen in primary care. Heart failure, a complex syndrome often accompanied by major comorbidity, is the most common reason for admission to hospital in the retired population and is associated with an in-hospital mortality rate as high as 10%.[18]

Not all patients with these cardiac conditions will be under the care of, or even reviewed by, the cardiology service and there is, therefore, a need for all healthcare professionals seeing patients with these common comorbidities to be aware of how this should influence the overall management plan.

A typical example would be when a patient with heart failure and chronically low blood pressure (due to appropriate treatment with a range of disease-modifying drugs such as an angiotensin-converting enzyme inhibitor, beta-blocker and aldosterone antagonist) is admitted to hospital. Automatically treating this patient as hypotensive or as fluid depleted, without thought of the heart failure, may lead to inappropriate decision making, with automatic stopping of chronic therapies or overzealous fluid replacement. Lack of monitoring for changes in fluid status in such a patient while treating their main complaint may also cause problems.

Being aware of potential drug–drug interactions and unintended consequences of medicine changes are key to successful decision making for patients with comorbidities. Avoiding non-steroidal anti-inflammatory drugs in patients with heart failure or remembering to temporarily stop anti-hypertensive drugs in a patient with sepsis and low blood pressure appear obvious but are

often forgotten when the team is focused on the main presenting problem.

Re-initiation of long-term drug therapy after an acute crisis is also relevant to patients living with chronic cardiovascular disease. Many patients are discharged without a plan to reintroduce therapies that will reduce their long-term risk (eg anti-hypertensive therapy, disease-modifying therapy for heart failure or oral anticoagulation to reduce the risk of atrial fibrillation-related thromboembolism).

Healthcare professionals also need to think about when they might need input from more specialist teams. There may be situations where the risk of benefit or harm is finely balanced, and seeking expert input may improve decision making. The Comorbidities Manager can help with all of these issues.

Depression

Poor mental health and associated disorders are consistently shown to be one of the leading causes of disability and a major contributor to the overall global burden of disease, depression being one of the most common among them.[19] This has become even more apparent during the challenging times of the COVID-19 pandemic that has restricted access to much needed support.[20] The relationship between depression and several physical conditions, such as diabetes and cardiovascular disease, is considered to be bidirectional.[21,22] Depression is a common comorbidity and early recognition and appropriate treatment is, indeed, paramount.[23]

An example would be stroke, where depression is not only a risk factor, but also present in one-third of patients surviving a stroke, with significant impact on adherence, functional rehabilitation and quality of life.[24] Choosing the appropriate treatment is a balancing act that requires relevant expertise.[25,26] The Comorbidities Manager gives detailed guidance on how to manage depression in patients with stroke and a range of other conditions.

This highlights the importance of being able to account for depression as a serious comorbidity at the point of consultation, whether it is in a busy emergency department or an outpatient clinic. Thinking about depression as an important comorbidity has the potential to minimise harm and maximise positive health outcomes. In support of this holistic approach to medical practice, novel digital health applications, such as the Comorbidities Manager, can make a real difference.[27]

Conclusion

There is a growing number of patients with multiple comorbidities. Managing such patients is challenging but better management will represent a strategic step change in the implementation of evidence-based medicine: moving from academe to the coalface, from fragmentation to high-quality and holistic care, and from the management of single diseases to comorbidities. ■

Conflicts of interest

Kieran Walsh works for BMJ, which produces the BMJ Comorbidities Manager.

Gerry Rayman, Asangaedem Akpan, Martin Cowie, Rachael Evans, Martyn Patel and Sotiris Posporelis have received consultancy fees for peer review for the BMJ.

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