

## Clinical pharmacists in chronic care

Abdul Kader Mohiuddin

Secretary & Treasurer, Dr. M. Nasirullah Memorial Trust, Tejgaon, Dhaka, Bangladesh

**\*Corresponding Author: Abdul Kader Mohiuddin**

Email: [trymohi@gmail.com](mailto:trymohi@gmail.com)

### Abstract

Pharmacy practice has changed substantially in recent years. The professionals have the opportunity to contribute directly to patient care in order to reduce morbimortality related to medication use, promoting health and preventing diseases. Healthcare organizations worldwide are under substantial pressure from increasing patient demand. Unfortunately, a cure is not always possible particularly in this era of chronic diseases, and the role of physicians has become limited to controlling and palliating symptoms. The increasing population of patients with long-term conditions are associated with high levels of morbidity, healthcare costs and GP workloads. Clinical pharmacy took over an aspect of medical care that had been partially abandoned by physicians. Overburdened by patient loads and the explosion of new drugs, physicians turned to pharmacists more and more for drug information, especially within institutional settings. Once relegated to counting and pouring, pharmacists headed institutional reviews of drug utilization and served as consultants to all types of health-care facilities. In addition, when clinical pharmacists are active members of the care team, they enhance efficiency by: Providing critical input on medication use and dosing. Working with patients to solve problems with their medications and improve adherence.

**Keywords:** Chronic care, Pharmacy intervention; diabetes care, CVD prevention, Inflammatory bowel disease.

### Background

Clinical pharmacology is a professional discipline that combines basic pharmacology and clinical medicine. A clinical pharmacist offers invaluable support in the development of a final prescription with better patient management and enhanced safety.<sup>1</sup> Its development began in the early 1950s, primarily as a result of the efforts of Harry Gold. Pharmacist rounding with inpatient hospital services has been traced to the University of Kentucky in 1957.<sup>1,2</sup> Drug therapy was becoming much more complex. Graham Calder pioneered a new role for pharmacists on hospital wards in Aberdeen.<sup>3</sup> The role of clinical pharmacists underwent important changes from the 1960s through 1990s as their participation in direct patient care increased. In the early 1970s, federal funding assisted with greatly expanding clinical pharmacy faculty in Colleges of Pharmacy.<sup>4</sup> Pharmacy education debated where clinical pharmacy fit within pharmacy training. The AACP spearheaded an effort to examine this issue. Till then, two full generations of pharmacists have been educated and trained after the general adoption of the aims of clinical pharmacy.<sup>4,5</sup> ACPE has revised the standards for colleges and schools of pharmacy several times since 2000. ACPE Standards 2016 go into effect July 1, 2016. To some extent, pharmacy took over an aspect of medical care that had been partially abandoned by physicians.<sup>6</sup> Overburdened by patient loads and the explosion of new drugs, physicians turned to pharmacists more and more for drug information, especially within institutional settings. A clinical pharmacist often has a somewhat different approach to the use of drugs and may give valuable supplementary information about for example interactions, during the physician's decision-making process concerning potential changes of and the follow-up of the medication.<sup>7,8</sup> The concept of pharmaceutical care emphasizes the pharmacists' responsibility to pursue the best possible patient outcomes of medication therapy.<sup>9</sup> They possess in-depth

knowledge of medications that is integrated with a foundational understanding of the biomedical, pharmaceutical, socio-behavioral, and clinical sciences.<sup>10</sup> To achieve desired therapeutic goals, the clinical pharmacist applies evidence-based therapeutic guidelines, evolving sciences, emerging technologies, and relevant legal, ethical, social, cultural, economic, and professional principles.<sup>11-13</sup> In accordance, clinical pharmacists assume responsibility and accountability for managing medication therapy in direct patient care settings, whether practicing independently or in consultation or collaboration with other health care professionals.<sup>14,15</sup> Their functions encompass comprehensive medication management (ie, prescribing, monitoring, and adjustment of medications), nonpharmacologic guidance, and coordination of care. Interdisciplinary collaboration allows pharmacists opportunities to provide direct patient care or consultations by telecommunication in many different clinical environments, including disease management, primary care, or specialty care.<sup>16-19</sup> Pharmacists may manage chronic or acute illnesses associated with endocrine, cardiovascular, respiratory, gastrointestinal, or other systems.<sup>20</sup> Clinical pharmacist researchers generate, disseminate, and apply new knowledge that contributes to improved health and quality of life.<sup>21-24</sup> Within the system of health care, clinical pharmacists are experts in the therapeutic use of medications. They routinely provide medication therapy evaluations and recommendations to patients and health care professionals.<sup>25,26</sup> Clinical pharmacists are a primary source of scientifically valid information and advice regarding the safe, appropriate, and cost-effective use of medications.<sup>27,28</sup> They obtain medical and medication history, check medication errors including prescription, dispensing and administration errors, identify drug interactions, monitor ADR, suggest individualization of dosage regimen, provide patient counseling, etc.<sup>29-35</sup> They also provide information about the use of drugs and medical

devices like inhaler, insulin pen, eye drops, nasal sprays, etc.<sup>36</sup> Participation of a clinical pharmacist in ward/ICU rounds and clinical discussions helps to identify, prevent or reduce drug interaction and ADR<sup>29,37-39</sup>



**Fig. 1:** Clinical pharmacy offers chronic care services like asthma, diabetes, nutritional supplement counseling, smoking cessation, weight reduction, geriatric care, hyperlipidaemia, hypertension, naturopathy and wound care. The integration of clinical pharmacists into primary care clinics could have positive effects on the clinical outcomes of patients in glycemic control, blood pressure, lipid profile, in accordance with current guidelines.

## Introduction

Population aging has increased the burden of chronic diseases globally. There are both ethical and practical imperatives to address health inequity issues related to chronic disease management for persons with social complexity, existing programs often do not appropriately address the needs of these individuals. This leads to low levels of participation in programs, suboptimal chronic disease management, and higher health-care utilization.<sup>40</sup> Unlike acute conditions, chronic diseases require consistent care and management outside of the healthcare setting, in the community or primary care setting, in terms of medication, lifestyle management, and health behavior modification.<sup>41-45</sup> It is typically a multi-component intervention that includes medication therapy review, patient medication education, medication monitoring, immunizations, disease self-care and support, and/or prescribing authority. Patients who take multiple medications due to chronic disease have a high risk of drug duplication, interaction, or adverse side effects, which could result in extended hospital stays and higher costs.<sup>46</sup> To increase the safety and effectiveness of treatment, these patients must have specific needs met, with regards to appropriate medication use.<sup>47</sup> Studies have shown that integrating pharmacists into ambulatory clinics can improve chronic disease management and optimal use of medications.<sup>48</sup> Furthermore, pharmacist involvement in patient care may help to reduce inappropriate medication use, specifically in the elderly. A study in Canada saw the proportion of patients receiving an inappropriate medication drop significantly after medication review and optimization by a team that included a pharmacist.<sup>49</sup> Compared to usual

care, pharmacist-led care was associated with similar incidences or rates of office, urgent care or ED visits, and hospitalizations and medication adherence, increased the number or dose of medications received and improved study-selected glycemic, blood pressure, and lipid goal attainment.<sup>50</sup> Another recent study shows telehealth-based chronic disease management program including clinical pharmacy specialists imparted statistically significant improvements in diabetes and hypertension outcomes along with clinically significant improvements in the areas of lipid management and tobacco cessation.<sup>51</sup>

## Diabetes Care

As the seventh-leading cause of death in the US, diabetes can lead to various health complications such as blindness, kidney disease, amputations, and heart disease. The worldwide existing prevalence of DM is about 425 million people, of whom 279 million are in urban areas and 146 million are in rural zones.<sup>52</sup> The IDF estimates that by 2040, one in 10 adults (642 million) will have diabetes. Around 50% (212.4 million) of patients are unaware of their diabetes. More than 12% of total global health expenditure goes to diabetes, according to IDF.<sup>53</sup> Annual worldwide economic cost of diabetic care was calculated at \$727 billion in year 2017 which is predicted to be \$776 billion for year 2045 respectively.<sup>54</sup> Currently, more than 230 million Asian individuals are living with diabetes, accounting for approximately 55% of the world's diabetic population. China and India collectively are home of nearly 110 million diabetic patients.<sup>55</sup> It is a risk factor for CVD and has been associated with 2- to 4-fold higher mortality<sup>56</sup> and another study says that half of all diabetic death was due to CVD.<sup>57</sup> The number of deaths caused by diabetes in the age range of 60–99 years in 2017 was 3,200,000.<sup>58</sup> About half of diabetes-related mortality (48%) occurs in people younger than 60 years and it continues to reduce life expectancy by 6–8 years in people diagnosed at the age of 50 years.<sup>59</sup> More than 35% patients did not receive any diabetes education, while 30% diabetic patients were compliant with drug regimens and the non-compliance was higher among the lower socioeconomic groups.<sup>60</sup> Pharmacist may provide a face-to-face counseling regarding knowledge on diabetes, self-monitoring of blood glucose, regular checkup of systolic blood pressure, body weight, and serum cholesterol levels. The pharmacist may also counsel regarding non-pharmacological management strategies such as diet control, exercise therapy, and early identification of symptoms of hypoglycemia (blurred vision, rapid heartbeat, sweating, fatigue, headache, dizziness, trouble thinking, seizures, and coma) and its management. In a satisfaction survey of 24 providers or clinical pharmacists, nearly 90% had favorable responses toward the protocol and its effect on access to and quality of care.<sup>61</sup> Management of DM remains a significant challenge in the US, as estimates indicate that greater than 40% of diabetes patients are uncontrolled with a HbA1c. Diabetic patients who received care from the collaborative team, including a clinical pharmacist, had improvement in most key indicators of diabetes like HbA1c, in both high- and low- income countries

and in both urban and rural areas.<sup>62-71</sup> Emphasizing medication adherence, particularly for patients with longer duration of diabetes and those with multiple comorbid diseases should be strongly considered in future diabetes management programs implemented to improve glycemic control in patients with type 2 diabetes.<sup>72</sup> A mobile phone text message can serve as a simple and cost-effective option in improving medication adherence and clinical outcomes by providing information between clinic visits has been reported.<sup>73,74</sup> A report from the National Diabetes Commission suggested that an inappropriate attitude of health care professionals toward diabetes could lead to poor patient outcomes.<sup>75</sup> In educational program, a clinical or community pharmacist can improve adherence by providing

medication consultation service, creating an individualized patient schedule on administration times and dosage of each medication, educating the patient on the importance of medication adherence, dietary adherence and exercise on better glycemic control, giving advice on how to reduce adverse effects of medications, and also by teaching how to take medications in the holy month of Ramadan or other religious fasting, and how to use pill boxes and diary logs to reduce forgetfulness. Literature indicates a number of interventional studies involving pharmacist-based educational interventions, showing clinically significant improvements in the clinical outcomes of the diabetes patients.<sup>76</sup>

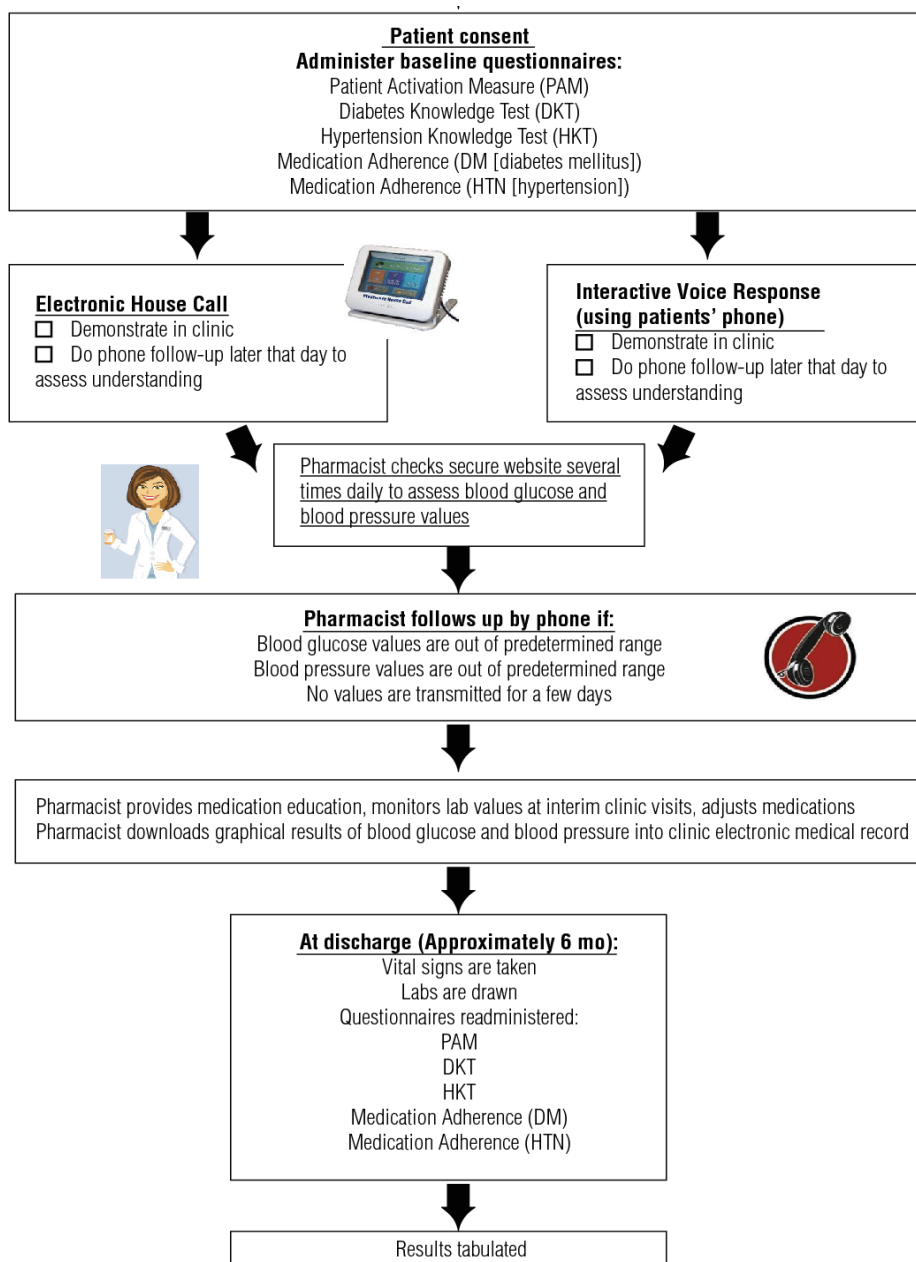


Fig. 2: Telemonitoring model for providing clinical pharmacy services to patients with diabetes.<sup>62</sup>

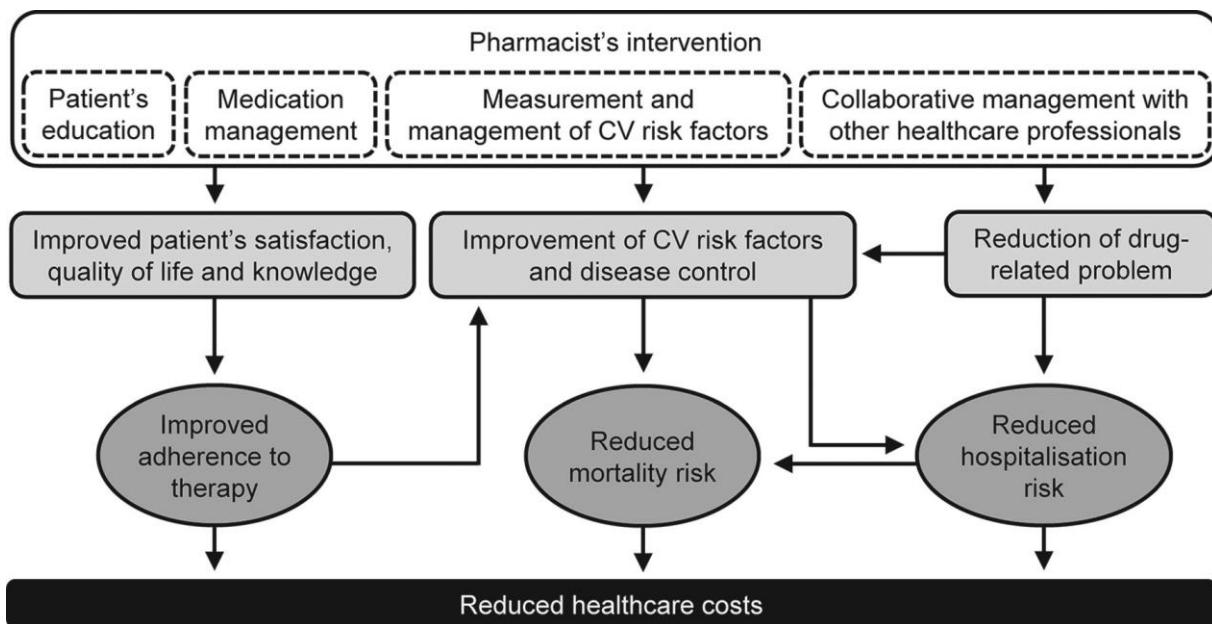
## CVD Prevention

Hypertension is the single most important risk factor for CVD and a key driver of global disease burden.<sup>77</sup> It is a major risk factor for CHD, stroke, retinopathies, and renal dysfunction. 18 million people die each year from CVDs, an estimated 31% of all deaths worldwide.<sup>78</sup> Of these deaths, 85% are due to MI and stroke.<sup>79</sup> CVD is currently the leading cause of morbidity and mortality and over 80% occur in LMICs.<sup>80</sup> Nearly 50% patients with chest pain related to exercise have obstructive coronary artery disease.<sup>81</sup> Coronary artery spasm plays an important role in the pathogenesis of IHD, including angina pectoris, MI, and sudden death, occurring most often from midnight to early morning.<sup>82</sup> A study of 1,015 patients with stable coronary artery disease showed a 4.4-fold increase in the risk of stroke and a 3.8-fold increase in the risk of death among patients who self-reported as nonadherent.<sup>83</sup> IHD has topped the list of causes of years of life lost for more than a decade, highlighting the shift in the global burden of disease from communicable to chronic disease. Risk factors for CVD, including raised blood pressure, hypercholesterolaemia and high BMI, are among the most important contributors to DALYs.<sup>84</sup> CVD claimed death of some 900,000 death in US in 2016.<sup>85</sup> BP is still uncontrolled in 50% of the US population with hypertension. Additionally, BP can remain poorly controlled despite up to six physician visits per year.<sup>86</sup> Across South Asia, overall hypertension prevalence is estimated to be 27%. Prospective Urban Rural Epidemiology study has shown more than 50% are unaware of it and up to 80% of hypertensive patients have low adherence to medication. Uncontrolled BP was found more than 50% in Bangladesh, 70% in Pakistan and almost 60% in Sri Lanka.<sup>87</sup> The goals of treatment of hypertension are to limit target organ damage, thereby reducing the morbidity and mortality associated with the disease.<sup>88</sup> Many factors including socioeconomic status, belief about medications, comorbidity, availability of medications, access to healthcare, level of health literacy, number of medications, duration of therapy, age, gender, culture, educational status, and knowledge of the disease and treatment have been associated with the rate of adherence. Lack of medication availability, low level of awareness about the disease and treatment, inability to afford medicines, mistrust in western medicine, and more trust on traditional and spiritual healers are very common in the rural population.<sup>89</sup> Non-drug therapies have been shown to lower BP, enhance antihypertensive drug efficacy, and decrease cardiovascular risk. All patients with hypertension and those in the prehypertensive category should be advised to make lifestyle modifications in addition to any pharmacologic treatment that they receive.<sup>90</sup> Surprisingly, 60%- 80% of the population around the world (according to WHO) are partially or fully dependent upon herbal drugs for primary healthcare.<sup>91</sup> Interactions of some ingredients in supplements with other anti-hypertensive and cardiovascular preparations are well-documented.<sup>92</sup> Green tea showed 85% decrease in plasma concentration of nadolol, for example.<sup>93</sup> The pharmacist may play a relevant role in primary and secondary prevention of cardiovascular diseases, mainly through patient

education and counselling, drug safety management, medication review (review of both drug-food and drug-drug interaction), monitoring and reconciliation, detection and control of specific cardiovascular risk factors (eg, blood pressure, blood glucose, serum lipids) and clinical outcomes.<sup>94</sup> Pharmacist intervention can increase patients' knowledge about their condition in a way that positively modifies their beliefs about medicines, increased medication intensification without significant change in medication adherence, modify factors affecting adherence, improve adherence and patient QoL by reducing BP levels in patients treated with antihypertensive agents, increased referral acceptance.<sup>86,95-99</sup> Interventions that were most effective included combinations of more convenient care, information, reminders, self-monitoring, reinforcement, counseling, family therapy, psychological therapy, crisis intervention, manual telephone follow-up, and supportive care.<sup>83</sup> Weight loss has been noted to modify risk factors via improving insulin sensitivity, reducing inflammation, decreasing blood pressure and modifying the lipid profile.<sup>100</sup> It is astonishing that 7–28% of patients with coronary heart disease still smoke, but around half of smokers are planning to quit.<sup>101</sup> The World Bank suggests that around 180 million tobacco related deaths could be prevented between now and 2050 if adult tobacco consumption decreased by 50% by 2020.<sup>102</sup> A clinical pharmacist trained for smoking cessation counselling can play a key role in providing such interventions, including the assessment of pharmacotherapy interactions with tobacco smoke.<sup>103</sup> Prescription smoking cessation medications include bupropion and varenicline.<sup>104</sup> A recent Canadian survey shows that pharmacist-led intervention resulted in more than 70% of patients using nicotine replacement therapy for smoking cessation.<sup>105</sup>

## Obesity Management

In every single country in the world, the incidence of obesity is rising continuously with coronary artery disease, hypertension, type 2 diabetes mellitus, respiratory disorders and dyslipidemia.<sup>106</sup> The WHO estimated that in 2016 more than 1.9 billion adults were overweight (nearly 40% of the population) and over 650 million (13% of the population) were people with obesity.<sup>107</sup> Globally, the annual cost of obesity-related diseases has reached \$2 trillion according to a recent report by McKinsey Global Institute.<sup>108</sup> Obesity increases cardiovascular risk through risk factors such as increased fasting plasma triglycerides, high LDL cholesterol, low HDL cholesterol, elevated blood glucose and insulin levels and high blood pressure.<sup>109,110</sup> Also, obesity causes cerebral vasculopathy, gallbladder lithiasis, arthropathy, ovarian polycytosis, sleep apnea syndrome, and some neoplasms.<sup>111</sup> Successful obesity treatment plans incorporate diet, exercise, behavior modification (with or without drug treatment), and/or surgical intervention.<sup>112</sup> Prior to recommending any treatment, the clinician must evaluate the patient for the presence of secondary causes of obesity, such as thyroid dysfunction.<sup>113,114</sup> If secondary causes are suspected, then a more complete diagnostic workup and appropriate therapy is important. The clinician should then



**Fig. 3:** Effects of pharmacist's intervention on humanistic, clinical and economic outcomes in patients with CVD.<sup>94</sup>

evaluate the patient for the presence and severity of other obesity-related diseases, evaluating appropriate lab tests as indicated. Based on the outcome of this medical evaluation, the patient should be counseled on the risks and benefits of available treatment options (along with obesity-related comorbidities, including T2D prevention, and improvements in dyslipidemia, hyperglycemia, osteoarthritis, stress incontinence, GERD, hypertension, and PCOS.<sup>115,116</sup> If obesity is present without other comorbid conditions, then the goal would be absolute weight loss. In the presence of comorbid conditions, relatively small reductions in total body weight can have significant effects on comorbidity.<sup>117</sup>

Pharmacists, commonly considered one of the most trustworthy and accessible health care professionals, are ideally situated to provide counseling for weight and lifestyle management. Well trained pharmacists to perform basic physical assessments such as weight, waist circumference, blood glucose monitoring, and pharmacotherapy counseling, while additional training could be easily obtained for services that would encompass dietary counseling, guidance on physical activity, and behavioral counseling<sup>108,119,120</sup> As pharmacists currently do not have a well-identified role in obesity management, but study results display that pharmacist intervention was beneficial.<sup>121</sup> According to Canadian Pharmacists Journal, 2016 pharmacist prescribing resulted in >3-fold more patients achieving target LDL-c levels.<sup>122</sup> Pharmacists who identify and treat patients with dyslipidemia, including those with inadequately controlled LDL cholesterol levels, are better than physicians at getting patients to goal.<sup>123</sup> Studies have demonstrated that pharmacist-led interventions, including lipid clinics, can help patients achieve these more aggressive goals.<sup>124,125</sup>

### Asthma & COPD management

Asthma and COPD are common chronic conditions that comprise nearly 80% of direct health care costs associated with respiratory diseases in the EU.<sup>126</sup> In the UK alone, 5.4 million patients are currently receiving treatment for asthma; of these, 1.1 million are children. Over three million people die of COPD worldwide each year, an estimated 6% of all deaths worldwide.<sup>127</sup> It is the second most common reason for emergency hospital admission. According to WHO, COPD has become the fourth leading cause of mortality in the US. It is estimated to become the fifth leading cause of disease burden in 2020.<sup>128</sup> In 2015 alone, the death toll due to asthma was 383,000 globally.<sup>129</sup> One in five individuals with a diagnosis of COPD, asthma, or both asthma and COPD in primary care settings have asthma-COPD overlap.<sup>130</sup> In COPD, the outpatient therapeutic and management goals are to reduce symptoms and risks from exacerbations, and to maintain drug therapy. In contrast with asthma, COPD is a disease caused by chronic and often daily exposure to noxious particles or gases. The small airways in COPD are gradually destroyed leading to chronic bronchitis and emphysema.<sup>131</sup> Optimal pharmacological treatment including rapid treatment of exacerbations, can improve symptoms, reduce exacerbation frequency, and improve exercise tolerance, while poor medication adherence and suboptimal inhaler technique negatively impact outcomes.<sup>132</sup> Adherence to inhaled medication is poor in the real world and shows great variability, ranging from as low as 20% to over 60%.<sup>133</sup> To improve adherence, the therapeutic decisions should be discussed with the patient and should take into consideration their lifestyle factors, demographic characteristics (age, comorbidities, physical limitations, psychological and cognitive status), and pharmacological factors (polypharmacy regimens) to choose the best inhaler device for that patient.<sup>134</sup> Pharmacist-led comprehensive therapeutic interchange program of COPD inhalers may provide 30%

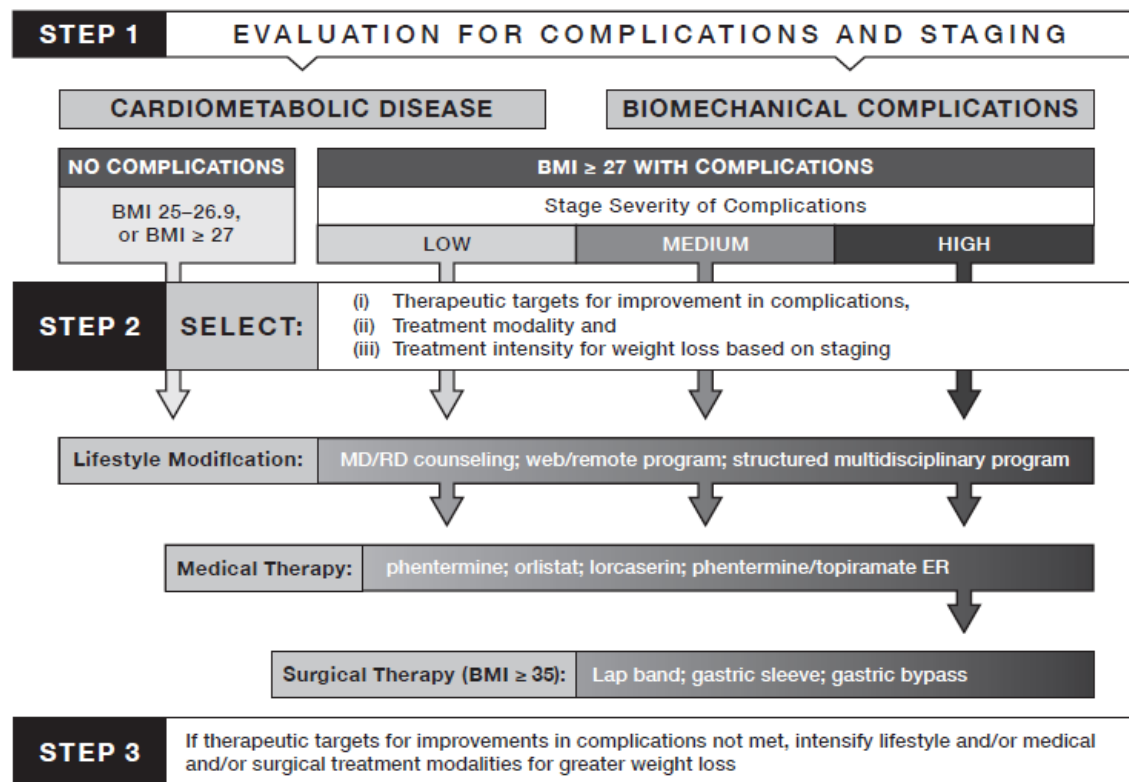


Fig. 4: 2013 AACE Obesity Treatment Algorithm<sup>118</sup>

pharmacy cost savings, improved medication adherence, knowledge of disease, decrease the number of prescriptions for exacerbations for these patients and reduces 30-day readmission rate.<sup>135-138</sup> A pharmacist-driven spirometry service was associated with quality testing results, identified respiratory disease abnormalities, and helped modifications of pulmonary drug regimens based on evidence-based guidelines.<sup>137</sup> Despite advances in inhaler device technology, estimates of those making inhaler errors range up to 90% of patients irrespective of the device type used. Poor inhaler technique accounted for over €750 million in direct and indirect costs in 2015 in the UK, Spain and Sweden.<sup>139</sup> By providing pharmaceutical care to patients with asthma, the pharmacist can help them to achieve treatment goals, e.g. improvement of disease control and reduction of asthma symptoms, exacerbations and medication-related side effects.<sup>140</sup> Step up of therapy comprised increasing or starting corticosteroid/long-acting beta agonist combination inhaler; corticosteroid inhaler; short-acting muscarinic antagonist inhaler; oral corticosteroid; oral montelukast; or long-acting muscarinic antagonist inhaler. Step down of therapy comprised reducing or stopping corticosteroid/long-acting beta agonist combination inhaler; corticosteroid inhaler; or long-acting muscarinic antagonist inhaler. The pharmacist conducted activities such as issuing asthma action plans, educating patients, recommending to step up/down therapy, reviewing inhaler technique and making other relevant recommendations such as device changes (e.g., dry-powder to metered-dose inhaler).<sup>141</sup> Polypharmacy is burdensome

and associated with patients hospitalized with acute exacerbations. It is plausible that repeated pharmacist intervention to ensure optimal pharmacotherapy and minimize adverse effects, with a direct link to a consultant respiratory physician, and the patient's GP, may lead to improved outcomes.<sup>142</sup> The interventions identified focused on key areas of asthma and COPD management and support including: assessment of current symptoms; assessment and rectification of inhaler technique; identification of medication-related problems; medication adherence; provision of written and oral education materials; smoking cessation.<sup>143</sup>

### Osteoporosis

Worldwide, it is estimated that 1 in 3 women above the age of 50 will experience osteoporotic fractures, as well as 1 in 5 men.<sup>145</sup> The prevalence of osteoporosis is projected to rise in the US from approximately 10 million people to more than 14 million people by 2020.<sup>146</sup> In 2015, direct medical costs totaled \$637.5 million for fatal fall injuries and \$31.3 billion for nonfatal fall injuries. During the same year, hospitalizations cost an average of \$30,550 per fall admission, totaling \$17.8 billion. By 2025, the cost of fractures in the US is expected to exceed \$25 billion each year to treat more than three million predicted fractures.<sup>147</sup> Similar to other chronic diseases, osteoporosis has struggled with suboptimal medication adherence, resulting in an increased risk of fractures and all-cause mortality. Two gaps in osteoporosis management are well documented: (a) most patients at high risk for fracture are not identified for

treatment, and (b) adherence to osteoporosis

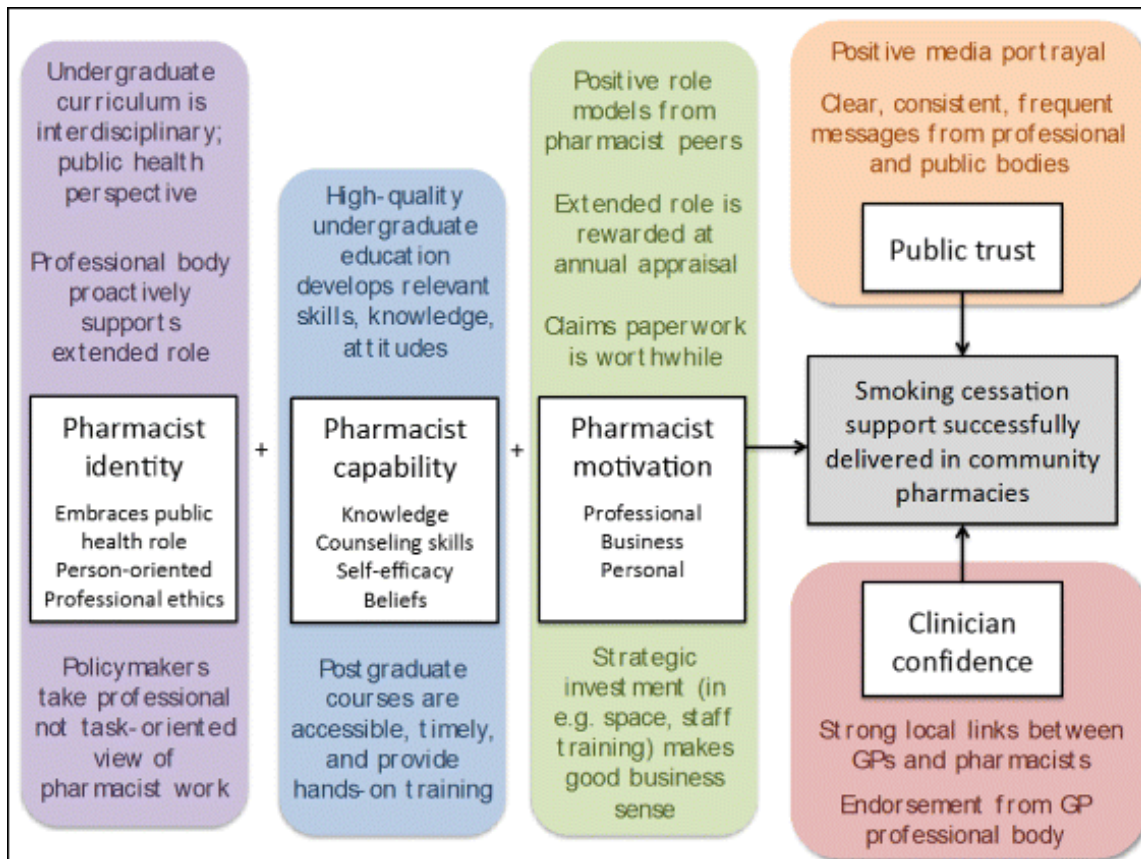
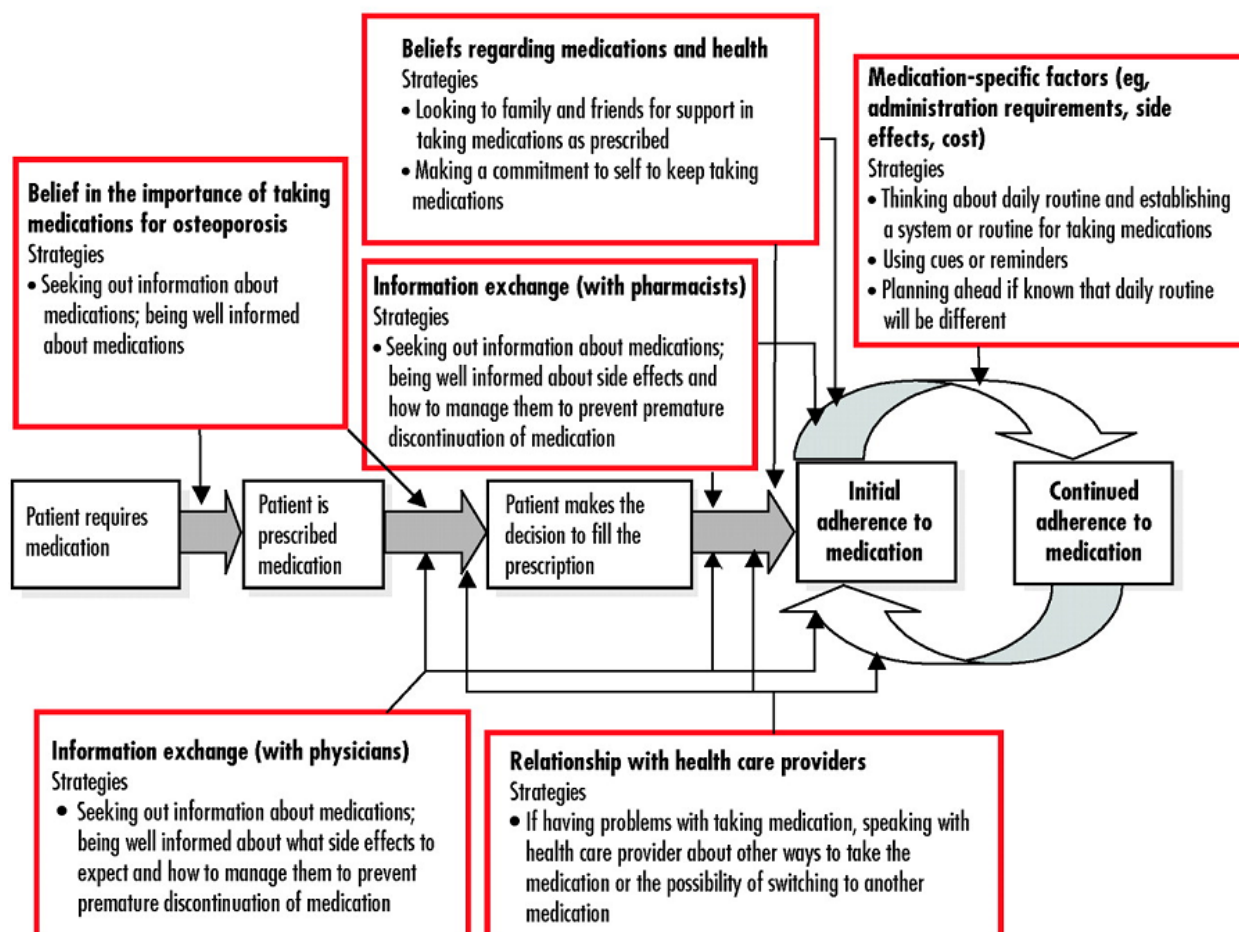


Fig. 5: Unifying model showing key influences on successful delivery of smoking cessation support by pharmacists.<sup>144</sup>

pharmacotherapy is suboptimal.<sup>148</sup> Nearly 50% osteoporosis patients are non-adherent to medications. Furthermore, approximately 50–70% of the patients discontinue their osteoporosis medications within the first year of initiation, which results in increased morbidity and mortality.<sup>149</sup> In October 2010, the US FDA issued a safety communication regarding the risks of atypical fractures of the femur, with bisphosphonates drugs, the safety communication appeared to have influenced osteoporosis utilization in Medicaid recipients.<sup>150</sup>

High patient cost and safety concerns are barriers for nearly 60% patients.<sup>152</sup> Improved osteoporosis medication adherence can reduce osteoporosis-related health care costs by preventing fractures. Persistent pharmacotherapy for osteoporosis is necessary to prevent osteoporotic fractures and to reduce osteoporosis-related health care costs.<sup>153</sup> Treatment strategies of osteoporosis include non-pharmacological treatment - diet rich of calcium and vitamin D, healthy lifestyle, proper exercise plan, and pharmacological therapy.<sup>154</sup> BMD monitoring after initiating anti-osteoporosis therapy in the routine clinical practice setting.<sup>155</sup> Hypercalciuria, malabsorption of calcium, hyperparathyroidism, vitamin D deficiency, hyperthyroidism, Cushing’s disease, and hypocalcemic hypercalcemia attributed to secondary causes to more than 30% women. Disorders of calcium metabolism and

hyperparathyroidism contributed to nearly 80% of the secondary causes.<sup>156</sup> Hormone replacement therapy (HRT) is not first-line therapy position for osteoporosis, but is best for prevention of osteoporosis.<sup>157</sup> However, different types of estrogen or progestogen, as well as different formulations, doses, timing of initiation, durations of therapy, and patient characteristics, may play different roles in the effects of HRT.<sup>158</sup> Pharmacist-physician collaboration is associated with higher treatment rates of osteoporosis.<sup>159</sup> Physicians and pharmacist should invest time to educate patients about the potential side effects and box warnings of estrogen use. Routine women wellness exams should also be focused on the development of any malignancies or adverse effects of hormone replacement therapy given a positive history. The pharmacist can play an important role at multiple levels: supporting patients in treatment, by providing information on the disease, its treatment, proper use of medication, adherence and persistence, as well as raising awareness for the prevention of osteoporosis and identifying patients at risk.<sup>160</sup> The counseling should include educating and assessing the patient for proper use of estrogen medication therapies as they may be prescribed in many various preparations of oral, transdermal, vaginal insert, and topical vaginal creams for positive patient compliance and adherence to therapy.<sup>147</sup>



**Fig. 6:** Mapping the factors influencing adherence and adherence strategies onto the medication-taking process in patients with osteoporosis.<sup>151</sup>

### Inflammatory Bowel Disease (IBD)

Inflammatory bowel disease (IBD) is a group of inflammatory conditions of the colon and small intestine. The two most common diseases are ulcerative colitis and Crohn's disease (CD). Crohn's disease can cause inflammation in any part of the digestive tract. Ulcerative colitis (UC) is an idiopathic inflammatory condition of the colon which results in diffuse friability and superficial erosions on the colonic wall associated with bleeding.<sup>161</sup> Although these diseases have undetermined etiology, research advances have outlined some of the pathways by which they occur: a) genetic predisposition associated with the environment induces a disruption of the intestinal microbial flora, b) the epithelial cells and the immune system of the intestine itself determine the risk of developing the disease.<sup>162</sup> Treatment of both, IBD and IBD associated pain is challenging. The mainstay of IBD treatment includes systemic immunosuppressive medications, such as corticosteroids, anti-tumor TNF antibodies or immunomodulators. Furthermore, the management of an acute flare differs from the strategies for maintenance of remission.<sup>163</sup> A total of about 66,000 US residents with a new IBD diagnosis each year, since 2015.<sup>164</sup> Direct costs (including consultations, drugs, hospitalization

and surgery) of UC amount to \$3.4 to \$8.6 billion in the US and €5.4 to €12.6 billion in EU.<sup>165</sup> The prevalent populations of patients with CD or UC in the UC in 2016 are expected to incur lifetime total costs of \$498 billion and \$377 billion, respectively.<sup>166</sup> IBD is a relapsing–remitting condition that causes inflammation and ulceration in the bowels, affecting approximately 500,000 people in the UK.<sup>167</sup>

The increasing incidence of IBD in developing countries parallels the westernization of diet, which includes higher calorie intake, especially from sugar, refined carbohydrates, animal proteins and ultra-processed foods and a lesser intake of fiber and fruits.<sup>168,169</sup> Incidence rate of IBD is stabilizing in some developed countries; however, the incidence rate is increasing in developing countries such as Asia and Eastern Europe.<sup>170</sup> Anxiety and depression are the most common psychological disorders in patients with IBD.<sup>171</sup> IBD is associated with significantly increased MI compared with non-IBD patients.<sup>172</sup> Patients with IBD are also at risk for asthma or COPD and bronchiectasis.<sup>173,174</sup> Sacroiliitis, an inflammatory arthropathy associated with ankylosing spondylitis, is found in patients with IBD but may go undiagnosed.<sup>175</sup> IBD patients showed increased risk for lymphoma and biliary cancer.<sup>176</sup> The general goals of treatment are to induce and maintain remission, minimize



complications and disease manifestations, and improve

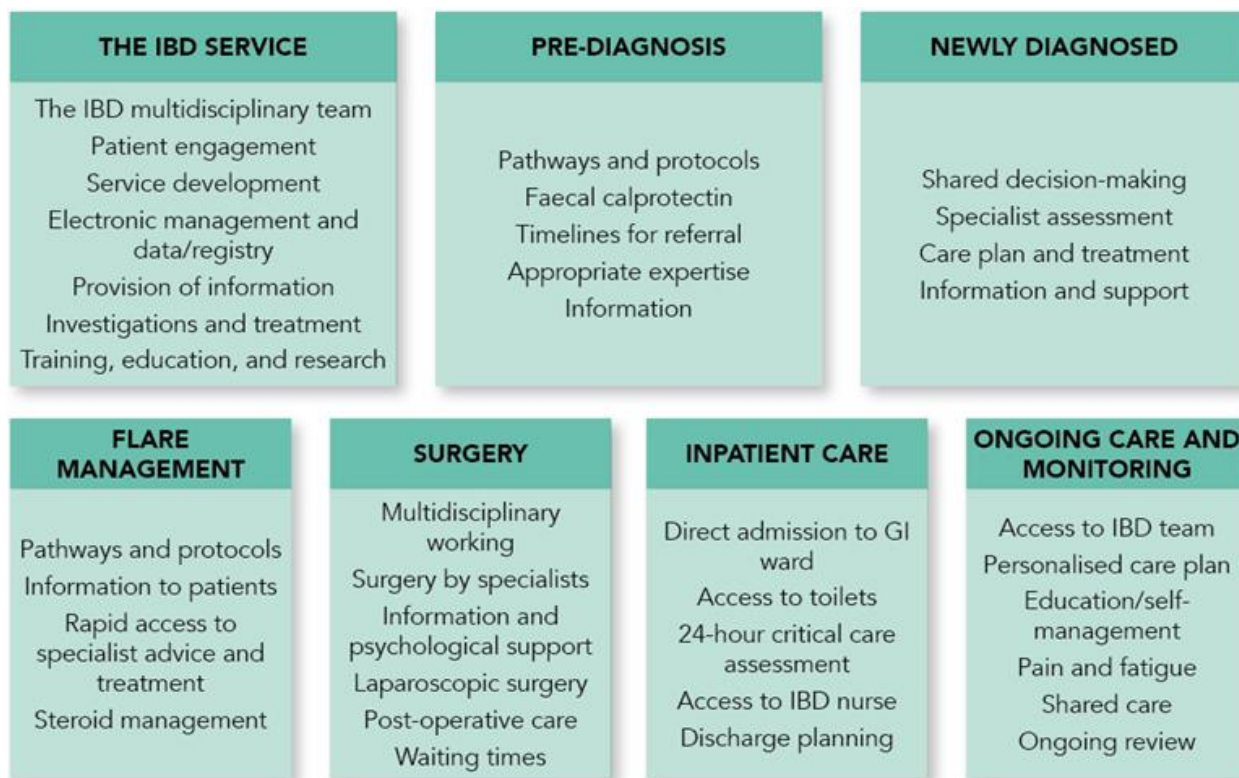


Fig. 7: The seven sections of the 2019 IBD Standards.<sup>167</sup>

overall QoL. Personalized IBD pharmacist adherence counselling, based on the Health Beliefs Model of medication perception, may increase medication adherence. Education using pamphlets and ad hoc physician education improved knowledge but not adherence.<sup>177</sup> IBD patients, mainly those having UC, need medications throughout their life with periodic dosing and occasionally, enemas and infusions may also be required. Treatment without adherence is highly regarded as the significant factor for relapse occurrence.<sup>178</sup> Medication nonadherence in IBD can be improved through a single personalized counseling session by IBD pharmacist adherence counselling (IPAC) intervention, and the benefit was durable for 2 years.<sup>179</sup> In addition to the disease, these patients are also managed with potent medications like steroids and biological agents, which have a host of adverse effects. Thus, the importance of the pharmacist who should be alert for any adverse reaction.<sup>180</sup> Pharmacist-led drug monitoring clinics measure thioguanine nucleotides and thiopurine methyltransferase levels four weeks after treatment with thiopurines is started to optimize outcomes.<sup>181</sup> In the event that insurance coverage cannot be obtained for the selected biologic response modifiers, the pharmacist identifies and discusses alternative options with the GI team; some of these options may include switching to another formulary agent or enrolling patients in medication assistance programs. Once insurance coverage of the medication is secured, the pharmacist educates the patient on self-administration, stability and storage requirements, and

potential adverse effects. Additionally, the pharmacist highlights the significance of compliance with laboratory monitoring and reviews the importance of communicating with the GI team in the event of potential infection, worsening disease control, or issues obtaining or using the medication. The IBD pharmacist has a key role in the management of IBD patients contributing not only to medication monitoring, prescribing, and safety but also allowing greater capacity in the physician's, often highly stretched IBD clinics.<sup>182</sup> Beyond medication therapy coordination from beginning to end, the pharmacist plays an active role in assisting with medication reconciliation and ensuring patients are current on necessary immunizations.<sup>183</sup> 40% of patients with CD do not respond to treatment with biologics, 30% to 50% achieve complete remission after six months and 30% of patients maintain the response for 12 months with continual treatment. Current strategies to overcome loss of response involve increasing the dose, decreasing the interval between administrations or switching to an alternative agent.<sup>181</sup>

**Conclusion**

The pharmacist's main responsibility is to maximize positive outcomes of drug therapy and minimize drug misadventures. Patient therapy should result in the achievement of definite outcomes that improve the patient's QoL. To date, numerous studies have found an increased rate of hospital admission rates secondary to medication noncompliance and/or adverse drug reactions. The actual number of DRPs necessitating

hospital admission may be higher than reported because of lack of documentation, further underestimating the problem. Initially, collecting and interpreting relevant patient information, identifying patient health-care needs, and formulating a DRP list may be challenging for the pharmacist. Preventive or chronic care is a challenge that should be undertaken by health care providers in all practice settings. Pharmacists should “seize the moment” to educate and counsel patients regarding these various topics when the opportunities arise. Clinical pharmacists use population health methods to generate chronic disease management referrals for patients with uncontrolled chronic conditions. Opportunities for pharmacists to help bring about awareness of recommendations and risk factors for the development of disease, and educate patients as to the benefits of prevention, occur daily. It is important for the pharmacists on the “front line” to have a general understanding of current recommendations for screening and disease prevention so that they can provide appropriate counseling and care for their patients. Also, pediatric clinical pharmacists have evolved over the last 2 decades and have proven to be a key player in the multidisciplinary team. Although, there are ample evidences of positive impact on clinical, humanistic and economic outcomes and the benefits of clinical pharmacists managing chronic conditions have been extensively published, their involvement in the multidisciplinary team providing care to patients with chronic cases, more high-quality research is warranted.

### Acknowledgement

I'm thankful to Dr. Christel G. Svingen, Deputy Director of Pharmacy Red Lake Indian Health Service Hospital, Minnesota for his valuable time to audit my paper and for his thoughtful suggestions. I'm also grateful to seminar library of Faculty of Pharmacy, University of Dhaka and BANSDOC Library, Bangladesh for providing me books, journal and newsletters.

### Abbreviations

American Association of Colleges of Pharmacy (AACP); Accreditation Council for Pharmacy Education (ACPE); International Diabetes Federation (IDF); Hemoglobin A1c (HbA1c); Ischemic Heart Disease (IHD); Myocardial Infarction (MI); Coronary Heart Disease (CHD); Disability-Adjusted Life Year (DALY); Quality of Life (QoL); Drug Related Problems (DRPs); Inflammatory bowel disease (IBD); Hormone replacement therapy (HRT); Bone-Mineral Density (BMD); Chronic obstructive pulmonary disease (COPD); LDL cholesterol (LDL-C); Gastroesophageal Reflux Disease (GERD)

### Financial Disclosure or Funding

N/A.

### Conflict of interest

The author declares that he has no competing interests.

### Informed Consent

*Santosh University Journal of Health Sciences, July-December, 2019;5(2):56-71*

N/A.

### Author contributions

N/A.

### References

1. Miller RR. History of clinical pharmacy and clinical pharmacology. *J Clin Pharmacol* 1981;21(4):195-7.
2. Somogyi A, Loke YK, Ferro A, Lewis LD, Cohen AF, Ritter JM. Clinical pharmacology: a declaration of intent. *Br J Clin Pharmacol* 2010;70(1):1-2. doi: 10.1111/j.1365-2125.2010.03706.x.
3. Calvert RT. Clinical pharmacy--a hospital perspective. *Br J Clin Pharmacol* 1999;47(3):231-8. Review. PubMed PMID: 10215745; PubMed Central PMCID: PMC2014215.
4. Carter BL. Evolution of Clinical Pharmacy in the USA and Future Directions for Patient Care. *Drugs Aging* 2016;33(3):169-77. doi: 10.1007/s40266-016-0349-2. Review. PubMed PMID: 26895454; PubMed Central PMCID: PMC4821736.
5. Dhingra S, Kumria R. A case report on the significance of clinical pharmacy services in India. *Clin Case Rep* 2014;2(3):86-7. doi: 10.1002/ccr3.63. Epub 2014 Mar 22. PubMed PMID: 25356256; PubMed Central PMCID: PMC4184600.
6. Lebovitz L, Eddington ND. Trends in the Pharmacist Workforce and Pharmacy Education. *Am J Pharm Educ* 2019;83(1):7051. doi: 10.5688/ajpe7051.
7. Veggeland T, Dyb S. The contribution of a clinical pharmacist to the improvement of medication at a geriatric hospital unit in Norway. *Pharm Pract (Granada)* 2008;6(1):20-4. Epub 2008 Mar 10. PubMed PMID: 25170361; PubMed Central PMCID: PMC4147275.
8. Horn E, Jacobi J. The critical care clinical pharmacist: evolution of an essential team member. *Crit Care Med* 2006;34(3 Suppl):S46-51. Review. PubMed PMID: 16477202.
9. Hazen ACM, de Bont AA, Leendertse AJ, Zwart DLM, de Wit NJ, de Gier JJ, Bouvy ML. How Clinical Integration of Pharmacists in General Practice has Impact on Medication Therapy Management: A Theory-oriented Evaluation. *Int J Integr Care* 2019;19(1):1. doi: 10.5334/ijic.3291.
10. Islam MA, Talukder RM, Taheri R, Blanchard N. Integration of Basic and Clinical Science Courses in US PharmD Programs. *Am J Pharm Educ* 2016;80(10):166. doi: 10.5688/ajpe8010166.
11. American College of Clinical Pharmacy. The definition of clinical pharmacy. *Pharmacother* 2008;28(6):816-7. doi: 10.1592/phco.28.6.816. PubMed PMID: 18503408.
12. McCarthy MW. Chapter 4. Clinical Pharmacy Skills. In: Michelle McCarthy and Denise Kockler. Oxford American Handbook of Clinical Pharmacy, published by Oxford University Press; 1 edition (December 2, 2009)
13. Institute of Medicine (US) Roundtable on Evidence-Based Medicine. Leadership Commitments to Improve Value in Healthcare: Finding Common Ground: Workshop Summary. Washington (DC): National Academies Press (US); 2009. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK52851/> doi: 10.17226/11982
14. Knoer SJ, Eck AR, Lucas AJ. A review of American pharmacy: education, training, technology, and practice. *J Pharm Health Care Sci* 2016;2:32. eCollection 2016.
15. Ma CS, Holuby RS, Bucci LL. Physician and pharmacist collaboration: the University of Hawaii at Hilo College of

- Pharmacy--JABSOM experience. *Hawaii Med J* 2010;69(6 Suppl 3):42-4.
16. Svingen CG. Clinical Pharmacist Credentialing and Privileging: A Process for Ensuring High-Quality Patient Care. *Fed Pract* 2019;36(4):155-7.
  17. Ismail S, Osman M, Abulezz R, Alhamdan H, Quadri KHM. Pharmacists as Interprofessional Collaborators and Leaders through Clinical Pathways. *Pharm (Basel)*. 2018;6(1). pii: E24. doi: 10.3390/pharmacy6010024.
  18. Ascione FJ. Preparing Pharmacists for Collaborative/Integrated Health Settings. *Pharmacy (Basel)*. 2019;7(2). pii: E47. doi: 10.3390/pharmacy7020047.
  19. Moreno G, Lonowski S, Fu J, Chon JS, Whitmire N, Vasquez C, Skootsky SA, Bell DS, Maranon R, Mangione CM. Physician experiences with clinical pharmacists in primary care teams. *J Am Pharm Assoc* (2003). 2017;57(6):686-91. doi: 10.1016/j.japh.2017.06.018.
  20. Al-Taani GM, Al-Azzam SI, Alzoubi KH, Aldeyab MA. Which drugs cause treatment-related problems? Analysis of 10,672 problems within the outpatient setting. *Ther Clin Risk Manag* 2018;14:2273-2281. doi: 10.2147/TCRM.S180747. eCollection 2018.
  21. Mohiuddin AK. Pharmacists in Public Health: Scope in Home and Abroad. *SOJ Pharm Pharm Sci* 2019;6(1):1-23. doi:10.15226/2374-6866
  22. Toklu HZ, Hussain A. The changing face of pharmacy practice and the need for a new model of pharmacy education. *J Young Pharm* 2013;5(2):38-40. doi: 10.1016/j.jyp.2012.09.001.
  23. Sakeena MHF, Bennett AA, McLachlan AJ. The Need to Strengthen the Role of the Pharmacist in Sri Lanka: Perspectives. *Pharmacy (Basel)*. 2019;7(2). pii: E54. doi: 10.3390/pharmacy7020054.
  24. Hammad EA, Qudah RA, Akour AA. The impact of clinical pharmacists in improving Jordanian patients' health outcomes. *Saudi Med J*. 2017;38(11):1077-89. doi: 10.15537/smj.2017.11.21453.
  25. Dalton K, Byrne S. Role of the pharmacist in reducing healthcare costs: current insights. *Integr Pharm Res Pract* 2017;6:37-46. doi: 10.2147/IPRP.S108047.
  26. Li J, Li Z. Differences and similarities in clinical pharmacy practice in China and the United States: a narrative review. *Eur J Hosp Pharm* 2018;25(1):2-5. doi: 10.1136/ejpharm-2016-001195.
  27. Tripathi S, Crabtree HM, Fryer KR, Graner KK, Arteaga GM. Impact of Clinical Pharmacist on the Pediatric Intensive Care Practice: An 11-Year Tertiary Center Experience. *J Pediatr Pharmacol Ther* 2015;20(4):290-8. doi: 10.5863/1551-6776-20.4.290.
  28. Mekonnen AB, Yesuf EA, Odegard PS, Wega SS. Implementing ward based clinical pharmacy services in an Ethiopian University Hospital. *Pharm Pract (Granada)* 2013;11(1):51-7.
  29. Francis J, Abraham S. Clinical pharmacists: Bridging the gap between patients and physicians. *Saudi Pharm J* 2014;22(6):600-2. doi: 10.1016/j.jsps.2014.02.011.
  30. Chalasani SH, Ramesh M, Gurumurthy P. Pharmacist-Initiated Medication Error-Reporting and Monitoring Programme in a Developing Country Scenario. *Pharm (Basel)* 2018;6(4). pii: E133. doi: 10.3390/pharmacy6040133.
  31. Ernawati DK, Lee YP, Hughes JD. Nature and frequency of medication errors in a geriatric ward: an Indonesian experience. *Ther Clin Risk Manag* 2014;10:413-21. doi: 10.2147/TCRM.S61687.
  32. Chamoun NR, Zeenny R, Mansour H. Impact of clinical pharmacy interventions on medication error nodes. *Int J Clin Pharm* 2016;38(6):1436-44.
  33. Gonzalez D, Rao GG, Bailey SC, Brouwer KLR, Cao Y, Crona DJ, et al. Precision Dosing: Public Health Need, Proposed Framework, and Anticipated Impact. *Clin Transl Sci* 2017;10(6):443-454. doi: 10.1111/cts.12490.
  34. Sanii Y, Torkamandi H, Gholami K, Hadavand N, Javadi M. Role of pharmacist counseling in pharmacotherapy quality improvement. *J Res Pharm Pract* 2016;5(2):132-7. doi: 10.4103/2279-042X.179580.
  35. Ip RNS, Tenney JW, Chu ACK, Chu PLM, Young GWM. Pharmacist Clinical Interventions and Discharge Counseling in Medical Rehabilitation Wards in a Local Hospital: A Prospective Trial. *Geriatrics (Basel)* 2018;3(3). pii: E53. doi: 10.3390/geriatrics3030053.
  36. Seidling HM, Lampert A, Lohmann K, Schiele JT, Send AJ, Witticke D, Haefeli WE. Safeguarding the process of drug administration with an emphasis on electronic support tools. *Br J Clin Pharmacol* 2013;76 Suppl 1:25-36. doi: 10.1111/bcp.12191.
  37. Bauer SR, Kane-Gill SL. Outcome Assessment of Critical Care Pharmacist Services. *Hosp Pharm* 2016;51(7):507-13. doi: 10.1310/hpj5107-507.
  38. Viana SSC, Arantes T, Ribeiro SCDC. Interventions of the clinical pharmacist in an Intermediate Care Unit for elderly patients. *Einstein (Sao Paulo)*. 2017;15(3):283-8. doi: 10.1590/S1679-45082017AO3894.
  39. Sjölander M, Gustafsson M, Gallego G. Doctors' and nurses' perceptions of a ward-based pharmacist in rural northern Sweden. *Int J Clin Pharm* 2017;39(4):953-959. doi: 10.1007/s11096-017-0488-5.
  40. van Oostrom SH, Picavet HS, de Bruin SR, Stirbu I, Korevaar JC, Schellevis FG, Baan CA. Multimorbidity of chronic diseases and health care utilization in general practice. *BMC Fam Pract* 2014;15:61. doi: 10.1186/1471-2296-15-61.
  41. Yi JY, Kim Y, Cho YM, Kim H. Self-management of Chronic Conditions Using mHealth Interventions in Korea: A Systematic Review. *Healthc Inform Res* 2018;24(3):187-97. doi: 10.4258/hir.2018.24.3.187.
  42. Kent K, Johnson JD, Simeon K, Frates EP. Case Series in Lifestyle Medicine: A Team Approach to Behavior Changes. *Am J Lifestyle Med* 2016;10(6):388-97. doi: 10.1177/15598276166638288.
  43. Middleton KR, Anton SD, Perri MG. Long-Term Adherence to Health Behavior Change. *Am J Lifestyle Med* 2013;7(6):395-404.
  44. Young S. Healthy behavior change in practical settings. *Perm J* 2014;18(4):89-92. doi: 10.7812/TPP/14-018.
  45. Newsom JT, Hugué N, McCarthy MJ, Ramage-Morin P, Kaplan MS, Bernier J, McFarland BH, Oderkirk J. Health behavior change following chronic illness in middle and later life. *J Gerontol B Psychol Sci Soc Sci* 2012;67(3):279-88. doi: 10.1093/geronb/gbr103.
  46. Zhang C, Zhang L, Huang L, Luo R, Wen J. Clinical pharmacists on medical care of pediatric inpatients: a single-center randomized controlled trial. *PLoS One* 2012;7(1):e30856. doi:10.1371/journal.pone.0030856.
  47. Han N, Han SH, Chu H, Kim J, Rhew KY, Yoon JH, et al. DrugTEAM Study group. Service design oriented multidisciplinary collaborative team care service model development for resolving drug related problems. *PLoS One* 2018;13(9):e0201705. doi: 10.1371/journal.pone.0201705.
  48. Tan EC, Stewart K, Elliott RA, George J. Pharmacist services provided in general practice clinics: a systematic review and meta-analysis. *Res Social Adm Pharm* 2014;10(4):608-22. doi: 10.1016/j.sapharm.2013.08.006.
  49. Fletcher J, Hogg W, Farrell B, Woodend K, Dahrouge S, Lemelin J, Dalziel W. Effect of nurse practitioner and pharmacist counseling on inappropriate medication use in family practice. *Can Fam Physician* 2012;58(8):862-8.
  50. Greer N, Bolduc J, Geurkink E, Rector T, Olson K, Koeller E, MacDonald R, Wilt TJ. Pharmacist-led Chronic Disease

- Management: A systematic review of effectiveness and harms compared with usual care. *Ann Intern Med* 2016. doi: 10.7326/M15-3058.
51. Litke J, Spoutz L, Ahlstrom D, Perdew C, Llamas W, Erickson K. Impact of the clinical pharmacy specialist in telehealth primary care. *Am J Health Syst Pharm* 2018;75(13):982-6. doi: 10.2146/ajhp170633.
  52. Meo SA, Sheikh SA, Sattar K, Akram A, Hassan A, Meo AS, Usmani AM, Qalbani E, Ullah A. Prevalence of type 2 diabetes mellitus among men in the middle east: a retrospective study. *Am J Mens Health* 2019;13(3):1557988319848577. doi: 10.1177/1557988319848577.
  53. Hughes JD, Wibowo Y, Sunderland B, Hoti K. The role of the pharmacist in the management of type 2 diabetes: current insights and future directions. *Integr Pharm Res Pract* 2017;6:15-27. doi: 10.2147/IPRP.S103783.
  54. Muc R, Saracen A, Grabska-Liberek I. Associations of Diabetic Retinopathy with Retinal Neurodegeneration on the Background of Diabetes Mellitus. Overview of Recent Medical Studies with an Assessment of the Impact on Healthcare systems. *Open Med (Wars)* 2018;13:130-6. doi: 10.1515/med-2018-0008.
  55. Yang, Jae Jeong. Association of diabetes with all-cause and cause-specific mortality in Asia: A pooled analysis of more than 1 million participants." JAMA network open vol. 2,4 e192696. 5 Apr. 2019, doi:10.1001/jamanetworkopen.2019.2696
  56. Raghavan S, Vassy JL, Ho YL, Song RJ, Gagnon DR, Cho K et al. Diabetes Mellitus-Related All-Cause and Cardiovascular Mortality in a National Cohort of Adults. *J Am Heart Assoc* 2019;8(4):e011295. doi: 10.1161/JAHA.118.011295.
  57. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007-2017. *Cardiovasc Diabetol* 2018;17(1):83. doi: 10.1186/s12933-018-0728-6.
  58. Longo M, Bellastella G, Maiorino MI, Meier JJ, Esposito K, Giugliano D. Diabetes and Aging: From Treatment Goals to Pharmacologic Therapy. *Front Endocrinol (Lausanne)*. 2019;10:45. doi: 10.3389/fendo.2019.00045. eCollection 2019.
  59. Ares J, Valdés S, Botas P, Sánchez-Ragnarsson C, Rodríguez-Rodero S, Morales-Sánchez P, Menéndez-Torre E, Delgado E. Mortality risk in adults according to categories of impaired glucose metabolism after 18 years of follow-up in the North of Spain: The Asturias Study. *PLoS One* 2019;14(1):e0211070. doi: 10.1371/journal.pone.0211070.
  60. Mohiuddin AK. Patient Compliance: Fact or Fiction?. *INNOVATIONS in pharmacy*. 2019;10(1):1-13. DOI: <https://doi.org/10.24926/iip.v10i1.1621>
  61. Al-Omar LT, Anderson SL, Cizmic AD, Vlasimsky TB. Implementation of a Pharmacist-Led Diabetes Management Protocol. *Am Health Drug Benefits* 2019;12(1):14-20.
  62. Gardea J, Papadatos J, Cadle R. Evaluating glycemic control for patient-aligned care team clinical pharmacy specialists at a large Veterans Affairs medical center. *Pharm Pract (Granada)* 2018;16(2):1164. doi: 10.18549/PharmPract.2018.02.1164.
  63. Shane-McWhorter L, McAdam-Marx C, Lenert L, Petersen M, Woolsey S, Coursey JM et al. Pharmacist-provided diabetes management and education via a telemonitoring program. *J Am Pharm Assoc* (2003). 2015;55(5):516-26. doi: 10.1331/JAPhA.2015.14285.
  64. Davis CS, Ross LAR, Bloodworth LS. The impact of clinical pharmacist integration on a collaborative interdisciplinary diabetes management team. *J Pharm Pract* 2017;30(3):286-90. doi: 10.1177/0897190016631894.
  65. Wallgren S, Berry-Cabán CS, Bowers L. Impact of clinical pharmacist intervention on diabetes-related outcomes in a military treatment facility. *Ann Pharmacother* 2012;46(3):353-7. doi: 10.1345/aph.1Q564.
  66. Ray S, Lokken J, Whyte C, Baumann A, Oldani M. The impact of a pharmacist-driven, collaborative practice on diabetes management in an Urban underserved population: a mixed method assessment. *J Interprof Care* 2019;1-9. doi: 10.1080/13561820.2019.1633289.
  67. Schmidt K, Caudill JA, Hamilton T. Impact of clinical pharmacy specialists on glycemic control in veterans with type 2 diabetes. *Am J Health Syst Pharm* 2019;76(Supplement\_1):S9-S14. doi: 10.1093/ajhp/zxy015.
  68. Sharp LK, Tilton JJ, Touchette DR, Xia Y, Mihailescu D, Berbaum ML, Gerber BS. Community Health Workers Supporting Clinical Pharmacists in Diabetes Management: A Randomized Controlled Trial. *Pharmacother* 2018;38(1):58-68. doi: 10.1002/phar.2058.
  69. Neves CM, Nascimento MMD, Silva DÁM, Ramalho-de-Oliveira D. Clinical Results of Comprehensive Medication Management Services in Primary Care in Belo Horizonte. *Pharm (Basel)* 2019 ;7(2). pii: E58. doi: 10.3390/pharmacy7020058.
  70. Jeong S, Lee M, Ji E. Effect of pharmaceutical care interventions on glycemic control in patients with diabetes: a systematic review and meta-analysis. *Ther Clin Risk Manag* 2018;14:1813-29. doi: 10.2147/TCRM.S169748.
  71. Wassell K, Sullivan J, Jett BP, Zuber J. Comparison of clinical pharmacy specialists and primary care physicians in treatment of type 2 diabetes mellitus in rural Veterans Affairs facilities. *Am J Health Syst Pharm* 2018;75(5 Supplement 1):S6-S12. doi: 10.2146/ajhp160905.
  72. Kharjul M, Braund R, Green J. The influence of pharmacist-led adherence support on glycaemic control in people with type 2 diabetes. *Int J Clin Pharm* 2018;40(2):354-9. doi: 10.1007/s11096-018-0606-z.
  73. Alqudah S, Jarab AS, Alefishat EA, Mayyas F, Khmour M, Pinto S. Factors Associated with Poor Hemoglobin A1c Control in Patients with Type 2 Diabetes. *Curr Diabetes Rev* 2019;15(2):164-70. doi: 10.2174/1573399814666180510144858.
  74. Peasah SK, Granitz K, Vu M, Jacob B. Effectiveness of a Student Pharmacist-Led Telephone Follow-Up Intervention to Improve Hemoglobin A(1C) in Diabetic Patients. *J Pharm Pract* 2019 Jun 25:897190019857409. doi: 10.1177/0897190019857409.
  75. Goruntla N, Mallela V, Nayakanti D. Impact of Pharmacist-directed Counseling and Message Reminder Services on Medication Adherence and Clinical Outcomes in Type 2 Diabetes Mellitus. *J Pharm Bioallied Sci* 2019;11(1):69-76. doi: 10.4103/jpbs.JPBS\_211\_18.
  76. Al Haqan AA, Al-Taweel DM, Awad A, Wake DJ. Pharmacists' Attitudes and Role in Diabetes Management in Kuwait. *Med Princ Pract* 2017;26(3):273-9. doi: 10.1159/000456088.
  77. Bukhsh A, Khan TM, Lee SWH, Lee LH, Chan KG, Goh BH. Efficacy of pharmacist based diabetes educational interventions on clinical outcomes of adults with type 2 diabetes mellitus: A network meta-analysis. *Front Pharmacol* 2018;9:339. doi: 10.3389/fphar.2018.00339.
  78. Okubadejo NU, Ozoh OB, Ojo OO, Akinkugbe AO, Odeniyi IA, Adegoke O et al. Prevalence of hypertension and blood pressure profile amongst urban-dwelling adults in Nigeria: a comparative analysis based on recent guideline recommendations. *Clin Hypertens* 2019;25:7. doi: 10.1186/s40885-019-0112-1.
  79. Web WHO. Cardiovascular disease. World Heart Day. Scale up prevention of heart attack and stroke. Available From: [https://www.who.int/cardiovascular\\_diseases/world-heart-day/en/](https://www.who.int/cardiovascular_diseases/world-heart-day/en/)

80. Web WHO. News/ Fact sheets/Detail/Cardiovascular diseases (CVDs). 17 May 2017. Available From: <http://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-cvds>
81. Ofori SN, Obosi J. Prevalence of hypertension among office workers in a multi-national company in the Niger-Delta with the 2017 American College of Cardiology/American Heart Association Blood Pressure Guidelines. *Prev Med Rep* 2019;15:100899. doi: 10.1016/j.pmedr.2019.100899.
82. Lanza GA. Diagnostic Approach to Patients with Stable Angina and No Obstructive Coronary Arteries. *Eur Cardiol* 2019 Jul 11;14(2):97-102. doi: 10.15420/ecr.2019.22.2.
83. Yasue H, Mizuno Y, Harada E. Coronary artery spasm - Clinical features, pathogenesis and treatment. *Proc Jpn Acad Ser B Phys Biol Sci* 2019;95(2):53-66. doi: 10.2183/pjab.95.005.
84. Ferdinand KC, Senatore FF, Clayton-Jeter H, Cryer DR, Lewin JC, Nasser SA et al. Improving Medication Adherence in Cardiometabolic Disease: Practical and Regulatory Implications. *J Am Coll Cardiol* 2017;69(4):437-51. doi: 10.1016/j.jacc.2016.11.034.
85. Hinton W, McGovern A, Coyle R, Han TS, Sharma P, Correa A, Ferreira F, de Lusignan S. Incidence and prevalence of cardiovascular disease in English primary care: a cross-sectional and follow-up study of the Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC). *BMJ Open* 2018;8(8):e020282. doi: 10.1136/bmjopen-2017-020282.
86. Mohiuddin Ak. Natural foods and Indian herbs of cardiovascular interest. *Pharm Pharmacol Int J*, 2019;7(2). doi:10.15406/ppij.2019.07.00235.
87. Gums TH, Uribe L, Vander Weg MW, James P, Coffey C, Carter BL. Pharmacist intervention for blood pressure control: medication intensification and adherence. *J Am Soc Hypertens* 2015;9(7):569-78. doi: 10.1016/j.jash.2015.05.005.
88. Mohiuddin AK. "Risks and Reasons Associated with Medication Non-Adherence." *J Clin Pharm* 2019;1(1):50-3. <https://innovationinfo.org/articles/JCP/JCP-105.pdf>.
89. Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier et al. ESC Scientific Document Group . 2018 ESC/ESH Guidelines for the management of arterial hypertension. *Eur Heart J*. 2018;39(33):3021-3104. doi: 10.1093/eurheartj/ehy339.
90. Niriayo YL, Ibrahim S, Kassa TD, Asgedom SW, Atey TM, Gidey K et al. Practice and predictors of self-care behaviors among ambulatory patients with hypertension in Ethiopia. *PLoS One* 2019;14(6):e0218947. doi: 10.1371/journal.pone.0218947.
91. National High Blood Pressure Education Program. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Bethesda (MD): National Heart, Lung, and Blood Institute (US); 2004 Aug. Treatment. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK9626/>
92. Mohiuddin AK. A Brief Review of Traditional Plants as Sources of Pharmacological Interests. *Open J Plant Sci* 2019:001-008. doi:10.17352/ojps.000015.
93. Mohiuddin AK. Traditional System of Medicine and Nutritional Supplementation: Use Vs Regulation. *J Clin Trials, Pathol Case Stud*, 2019;4(1):5-30.
94. Mohiuddin AK. Patient History and Medical Record: Proper Solution from Accurate Problem Identification. *Med Med Sci* 2019;7(7):82-6. doi:10.15413/mms.2019.0112.
95. Omboni S, Caserini M. Effectiveness of pharmacist's intervention in the management of cardiovascular diseases. *Open Heart* 2018;3;5(1):e000687. doi: 10.1136/openhrt-2017-000687.
96. Morgado M, Rolo S, Castelo-Branco M. Pharmacist intervention program to enhance hypertension control: a randomised controlled trial. *Int J Clin Pharm* 2011;33(1):132-40. doi: 10.1007/s11096-010-9474-x.
97. Bex SD, Boldt AS, Needham SB, Bolf SM, Walston CM, Ramsey DC et al. Effectiveness of a hypertension care management program provided by clinical pharmacists for veterans. *Pharmacother*. 2011;31(1):31-8. doi: 10.1592/phco.31.1.31.
98. Von Muenster SJ, Carter BL, Weber CA, Ernst ME, Milchak JL, Steffensmeier JJ et al. Description of pharmacist interventions during physician-pharmacist co-management of hypertension. *Pharm World Sci* 2008;30(1):128-35.
99. Ramanath K, Balaji D, Nagakishore Ch, Kumar SM, Bhanuprakash M. A study on impact of clinical pharmacist interventions on medication adherence and quality of life in rural hypertensive patients. *J Young Pharm* 2012;4(2):95-100. doi: 10.4103/0975-1483.96623.
100. Bhat S, Kroehl M, Yi WM, Jaeger J, Thompson AM, Lam HM et al. Factors influencing the acceptance of referrals for clinical pharmacist managed disease states in primary care. *J Am Pharm Assoc* (2003). 2019;59(3):336-42. doi: 10.1016/j.japh.2019.02.008.
101. Kane JA, Mehmood T, Munir I, Kamran H, Kariyanna PT, Zhyvotovska A, Yusupov D, Suleman UJ, Gustafson DR, McFarlane SI. Cardiovascular Risk Reduction Associated with Pharmacological Weight Loss: A Meta-Analysis. *Int J Clin Res Trials* 2019;4(1).pii: 131. doi: 10.15344/2456-8007/2019/131.
102. Hasegawa K, Komiyama M, Takahashi Y. Obesity and cardiovascular risk after quitting smoking: The latest evidence. *Eur Cardiol* 2019;14(1):60-1. doi: 10.15420/ecr.2019.4.2.
103. El Hajj MS, Kheir N, Al Mulla AM, Shami R, Fanous N, Mahfoud ZR. Effectiveness of a pharmacist-delivered smoking cessation program in the State of Qatar: a randomized controlled trial. *BMC Public Health* 2017;17(1):215. doi: 10.1186/s12889-017-4103-4.
104. Dobrin M, Blanc AL, Rouiller F, Christen G, Coronado M, Tagan D, Schäli C. Clinical pharmacist's role in implementing a smoking cessation intervention in a Swiss regional hospital: an exploratory study. *Int J Clin Pharm* 2014;36(3):526-34. doi: 10.1007/s11096-014-9927-8.
105. El Hajj MS, Awaisu A, Kheir N, Mohamed MHN, Haddad RS, Saleh RA et al. Evaluation of an intensive education program on the treatment of tobacco-use disorder for pharmacists: a study protocol for a randomized controlled trial. *Trials* 2019;20(1):25. doi: 10.1186/s13063-018-3068-7.
106. Li VW, Lam J, Heise P, Reid RD, Mullen KA. Implementation of a Pharmacist-Led Inpatient Tobacco Cessation Intervention in a Rehabilitation Hospital: A Before-and-After Pilot Study. *Can J Hosp Pharm* 2018;71(3):180-6.
107. Klop B, Elte JW, Cabezas MC. Dyslipidemia in obesity: mechanisms and potential targets. *Nutrients*. 2013;5(4):1218-40. doi: 10.3390/nu5041218.
108. Cercato C, Fonseca FA. Cardiovascular risk and obesity. *Diabetol Metab Syndr* 2019;11:74. doi: 10.1186/s13098-019-0468-0. eCollection 2019.
109. Jordan MA, Harmon J. Pharmacist interventions for obesity: improving treatment adherence and patient outcomes. *Integr Pharm Res Pract* 2015;4:79-89. doi: 10.2147/IPRP.S72206.
110. Carbone S, Canada JM, Billingsley HE, Siddiqui MS, Elagizi A, Lavie CJ. Obesity paradox in cardiovascular disease: where do we stand? *Vasc Health Risk Manag*. 2019 May 1;15:89-100. doi: 10.2147/VHRM.S168946.
111. Koliaki C, Liatis S, Kokkinos A. Obesity and cardiovascular disease: revisiting an old relationship. *Metab* 2019;92:98-107. doi: 10.1016/j.metabol.2018.10.011.

112. De Lorenzo A, Gratteri S, Gualtieri P, Cammarano A, Bertucci P, Di Renzo L. Why primary obesity is a disease? *J Transl Med* 2019;17(1):169. doi: 10.1186/s12967-019-1919-y.
113. Nuffer, Monika. "Integrative Health and Medicine: Dietary Supplements and Modalities for the Treatment of Obesity." Nutrition in the Prevention and Treatment of Abdominal Obesity, 2019, pp. 393–408., doi:10.1016/b978-0-12-816093-0.00027-6.
114. Butryn ML, Webb V, Wadden TA. Behavioral treatment of obesity. *Psychiatr Clin North Am* 2011;34(4):841-59. doi: 10.1016/j.psc.2011.08.006.
115. Sanyal D, Raychaudhuri M. Hypothyroidism and obesity: An intriguing link. *Indian J Endocrinol Metab* 2016;20(4):554-7. doi: 10.4103/2230-8210.183454.
116. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. *J Am Assoc Nurse Pract* 2017;29(S1):S3-S14. doi: 10.1002/2327-6924.12510.
117. Tsai, Adam Gilden, Daniel H. Bessesen. "Obesity." *Ann Internal Med* 2019;170(5) doi:10.7326/aitc201903050.
118. Tsai AG. Why I Treat Obesity. *Perm J*. 2019;23. doi: 10.7812/TPP/18-240. Epub 2019 May 15.
119. Garber, Alan. "AACE Comprehensive Diabetes Management Algorithm 2013." *Endocr Pract* 2013;19(2):327–36. doi:10.4158/endorp.19.2.a38267720403k242.
120. DeGeeter, Michelle. Results of a Pharmacist Intervention on Weight Parameters and A1c Compared to Standard Patient Care. *J Pharm Technol jPT : Official Publication of the Association of Pharmacy Technicians* 2018;34(5) (2018): 194–198. doi:10.1177/8755122518779338
121. Zanni GR. Hyperlipidemia: Updated Guidelines Impact Counseling. *Pharmacy Times*, 10 December, 2014.
122. Hetro A, Rossetto J, Bahlawan N, Ryan M. Clinical pharmacists supporting patients with diabetes and/or hyperlipidemia in a military medical home. *J Am Pharm Assoc* (2003). 2015;55(1):73-6. doi: 10.1331/JAPhA.2015.14103.
123. Tsuyuki RT, Rosenthal M, Pearson GJ. A randomized trial of a community-based approach to dyslipidemia management: Pharmacist prescribing to achieve cholesterol targets (RxACT Study). *Can Pharm J (Ott)*. 2016;149(5):283-92.
124. O'Riordan M. Pharmacist Management of High Cholesterol Gets More Patients to Goal, Lowers LDL Levels: RxACT. *TCTMD News*, September 29, 2016.
125. Joel C Mars. Pharmacy Perspectives in Dyslipidemia Management. *US Pharmacist*, December 2010. Available from: <https://www.uspharmacist.com/courses/107084/phs1005.pdf>
126. Cassagnol, Manouchkathe. "New Therapeutic Alternatives for the Management of Dyslipidemia." *J Pharm Pract*, 2013;26(6):528–40. doi:10.1177/0897190013507582.
127. Lewis A, Torvinen S, Dekhuijzen PN, Chrystyn H, Watson AT, Blackney M, Plich A. The economic burden of asthma and chronic obstructive pulmonary disease and the impact of poor inhalation technique with commonly prescribed dry powder inhalers in three European countries. *BMC Health Serv Res*. 2016 Jul 12;16:251. doi: 10.1186/s12913-016-1482-7.
128. Xin C, Xia Z, Jiang C, Lin M, Li G. The impact of pharmacist-managed clinic on medication adherence and health-related quality of life in patients with COPD: a randomized controlled study. *Patient Prefer Adherence*. 2016 Jul 11;10:1197-203. doi: 10.2147/PPA.S110167.
129. Usmani OS. Choosing the right inhaler for your asthma or COPD patient. *Ther Clin Risk Manag*. 2019 Mar 14;15:461-472. doi: 10.2147/TCRM.S160365. eCollection 2019.
130. Mubarak N, Hatah E, Khan TM, Zin CS. A systematic review and meta-analysis of the impact of collaborative practice between community pharmacist and general practitioner on asthma management. *J Asthma Allergy* 2019;12:109-53. doi: 10.2147/JAA.S202183.
131. Duong TN, Zeki AA, Louie S. Medical Management of Hospitalized Patients with Asthma or Chronic Obstructive Pulmonary Disease. *Hosp Med Clin* 2017;6(4):437-55. doi: 10.1016/j.ehmc.2017.05.002.
132. Krishnan JA, Nibber A, Chisholm A, Price D, Bateman ED, Bjermer L et al. Prevalence and Characteristics of Asthma-Chronic Obstructive Pulmonary Disease Overlap in Routine Primary Care Practices. *Ann Am Thorac Soc* 2019;16(9):1143-50. doi: 10.1513/AnnalsATS.201809-607OC.
133. López-Campos JL, Quintana Gallego E, Carrasco Hernández L. Status of and strategies for improving adherence to COPD treatment. *Int J Chron Obstruct Pulmon Dis*. 2019 Jul 10;14:1503-1515. doi: 10.2147/COPD.S170848.
134. Jardim JR, Nascimento OA. The Importance of Inhaler Adherence to Prevent COPD Exacerbations. *Med Sci (Basel)*. 2019 Apr 1;7(4). pii: E54. doi: 10.3390/medsci7040054.
135. Abdulsalim S, Unnikrishnan MK, Manu MK, Alsaahli S, Alrasheedy AA, Martin AP et al. Impact of a Clinical Pharmacist Intervention on Medicine Costs in Patients with Chronic Obstructive Pulmonary Disease in India. *Pharmacoecoon Open*. 2019 Jul 31. doi: 10.1007/s41669-019-0172-x.
136. McGurran MA, Richter LM, Leedahl ND, Leedahl DD. Impact of a Comprehensive COPD Therapeutic Interchange Program on 30-Day Readmission Rates in Hospitalized Patients. *P T*. 2019;44(4):185-91.
137. Cawley MJ, Warning WJ 2nd. Impact of a Pharmacist-driven Spirometry Clinic Service within a Community Family Health Center: A 5-year Retrospective Review. *J Res Pharm Pract* 2018;7(2):88-94. doi: 10.4103/jrpp.JRPP\_17\_101.
138. Ottenbros S, Teichert M, de Groot R, Griens F, Sodihardjo F, Wensing M et al. Pharmacist-led intervention study to improve drug therapy in asthma and COPD patients. *Int J Clin Pharm* 2014;36(2):336-44. doi: 10.1007/s11096-013-9887-4.
139. Usmani OS, Lavorini F, Marshall J, Dunlop WCN, Heron L, Farrington E, Dekhuijzen R. Critical inhaler errors in asthma and COPD: a systematic review of impact on health outcomes. *Respir Res* 2018;19(1):10. doi: 10.1186/s12931-017-0710-y.
140. Kuipers E, Wensing M, Wong-Go E, Daemen BJJ, De Smet PAGM, Teichert M. Adherence to guideline recommendations for asthma care in community pharmacies: actual and needed performance. *NPJ Prim Care Respir Med* 2019;29(1):26. doi: 10.1038/s41533-019-0139-5.
141. Deeks LS, Kosari S, Boom K, Peterson GM, Maina A, Sharma R, Naunton M. The Role of Pharmacists in General Practice in Asthma Management: A Pilot Study. *Pharm (Basel)* 2018;6(4). pii: E114. doi: 10.3390/pharmacy6040114.
142. Hunt V, Anderson D, Lowrie R, Montgomery Sardar C, Ballantyne S, Bryson G et al. A non-randomised controlled pilot study of clinical pharmacist collaborative intervention for community dwelling patients with COPD. *NPJ Prim Care Respir Med* 2018;28(1):38. doi: 10.1038/s41533-018-0105-7.
143. Twigg MJ, Wright DJ. Community pharmacy COPD services: what do researchers and policy makers need to know? *Integr Pharm Res Pract* 2017;6:53-9. doi: 10.2147/IPRP.S105279
144. Greenhalgh T, Macfarlane F, Steed L, Walton R. What works for whom in pharmacist-led smoking cessation support: realist review. *BMC Med* 2016;14(1):209.
145. Kadam NS, Chiplonkar SA, Khadilkar AV, Khadilkar VV. Prevalence of Osteoporosis in Apparently Healthy Adults above 40 Years of Age in Pune City, India. *Indian J Endocrinol Metab* 2018;22(1):67-73. doi: 10.4103/ijem.IJEM\_438\_17.
146. Patel D, Worley JR, Volgas DA, Crist BD. The Effectiveness of Osteoporosis Screening and Treatment in the Midwest. *Geriatr Orthop Surg Rehabil* 2018;9:2151459318765844. doi: 10.1177/2151459318765844.

147. Tu KN, Lie JD, Wan CKV, Cameron M, Austel AG, Nguyen JK, Van K, Hyun D. Osteoporosis: A Review of Treatment Options. *P T* 2018;43(2):92-104.
148. Elias MN, Burden AM, Cadarette SM. The impact of pharmacist interventions on osteoporosis management: a systematic review. *Osteoporos Int* 2011;22(10):2587-96. doi: 10.1007/s00198-011-1661-7.
149. Jaleel A, Saag KG, Danila MI. Improving drug adherence in osteoporosis: an update on more recent studies. *Ther Adv Musculoskelet Dis* 2018;10(7):141-9. doi: 10.1177/1759720X18785539.
150. Balkhi B, Seoane-Vazquez E, Rodriguez-Monguio R. Changes in the utilization of osteoporosis drugs after the 2010 FDA bisphosphonate drug safety communication. *Saudi Pharm J* 2018;26(2):238-43. doi: 10.1016/j.jsps.2017.12.005.
151. Lau E, Papaioannou A, Dolovich L, Adachi J, Sawka AM, Burns S et al. Patients' adherence to osteoporosis therapy: exploring the perceptions of postmenopausal women. *Can Fam Physician* 2008;54(3):394-402.
152. McGreevy JL, Kane MP, Busch RS, Bakst G, ElDeiry S. A pharmacist-run anabolic osteoporosis clinic: An abaloparatide descriptive report. *J Am Pharm Assoc* (2003). 2019;59(4):593-7. doi: 10.1016/j.japh.2019.03.017.
153. Cho H, Byun JH, Song I, Kim HY, Ha YC, Kim TY et al. Effect of improved medication adherence on health care costs in osteoporosis patients. *Med (Baltimore)*. 2018;97(30):e11470. doi: 10.1097/MD.00000000000011470.
154. Ivanova S, Vasileva L. Current and Emerging Strategies in Osteoporosis Management. *Curr Pharm Des* 2017;23(41):6279-87. doi: 10.2174/1381612823666170714122714.
155. Leslie WD, Morin SN, Martineau P, Bryant M, Lix LM. Association of Bone Density Monitoring in Routine Clinical Practice With Anti-Osteoporosis Medication Use and Incident Fractures: A Matched Cohort Study. *J Bone Miner Res* 2019. doi: 10.1002/jbmr.3813.
156. Tit DM, Bungau S, Iovan C, Nistor Cseppento DC, Endres L, Sava C et al. Effects of the Hormone Replacement Therapy and of Soy Isoflavones on Bone Resorption in Postmenopause. *J Clin Med* 2018;7(10). pii: E297. doi: 10.3390/jcm7100297.
157. Fait T. Menopause hormone therapy: latest developments and clinical practice. *Drugs Context* 2019;8:212551. doi: 10.7573/dic.212551.
158. Zuo H, Sun A, Gao L, Xue W, Deng Y, Wang Y, Zhu S, Ma X, Xin H. Effect of Menopausal Hormone Therapy on Bone Mineral Density in Chinese Women: A 2-Year, Prospective, Open-Label, Randomized-Controlled Trial. *Med Sci Monit* 2019;25:819-26. doi: 10.12659/MSM.912166.
159. Bowers BL, Drew AM, Verry C. Impact of Pharmacist-Physician Collaboration on Osteoporosis Treatment Rates. *Ann Pharmacother* 2018;52(9):876-83. doi: 10.1177/1060028018770622.
160. Duquet N. [Osteoporosis: treatment and pharmaceutical care]. *J Pharm Belg* 2014;(2):14-24.
161. Uhlig HH. Monogenic diseases associated with intestinal inflammation: implications for the understanding of inflammatory bowel disease. *Gut* 2013;62(12):1795-805. doi: 10.1136/gutjnl-2012-303956.
162. Cury DB, Oliveira R, Cury MS. Inflammatory bowel diseases: time of diagnosis, environmental factors, clinical course, and management - a follow-up study in a private inflammatory bowel disease center (2003-2017). *J Inflamm Res* 2019;12:127-35. doi: 10.2147/JIR.S190929.
163. Bon L, Scharl S, Vavricka S, Rogler G, Fournier N, Pittet V et al. Swiss IBD Cohort Study Group. Association of IBD specific treatment and prevalence of pain in the Swiss IBD cohort study. *PLoS One* 2019;14(4):e0215738. doi: 10.1371/journal.pone.0215738.
164. Aniwan S, Harmsen WS, Tremaine WJ, Loftus EV Jr. Incidence of inflammatory bowel disease by race and ethnicity in a population-based inception cohort from 1970 through 2010. *Therap Adv Gastroenterol* 2019 Feb 6;12:1756284819827692. doi: 10.1177/1756284819827692.
165. Ye BD, Travis S. Improving the quality of care for inflammatory bowel disease. *Intest Res* 2019;17(1):45-53. doi: 10.5217/ir.2018.00113.
166. Lichtenstein GR, Shahabi A, Seabury SA, Lakdawalla DN, Espinosa OD, Green S, Brauer M, Baldassano RN. Lifetime Economic Burden of Crohn's Disease and Ulcerative Colitis by Age at Diagnosis. *Clin Gastroenterol Hepatol* 2019. pii: S1542-3565(19)30765-7. doi: 10.1016/j.cgh.2019.07.022.
167. Barrett K, Glatter J. New standards for IBD aim to improve patient experience and outcomes. Guidelines in Practice (Gastrointestinal) UK, 27 July 2019.
168. Sood A, Ahuja V, Kedia S, Midha V, Mahajan R, Mehta V et al. Diet and inflammatory bowel disease: The Asian Working Group guidelines. *Indian J Gastroenterol* 2019;38(3):220-46. doi: 10.1007/s12664-019-00976-1.
169. Rizzello F, Spisni E, Giovanardi E, Imbesi V, Salice M, Alvisi P et al. Implications of the Westernized Diet in the Onset and Progression of IBD. *Nutrients* 2019;11(5). pii: E1033. doi: 10.3390/nu11051033.
170. Malekzadeh MM, Sima A, Alatab S, Sadeghi A, Daryani NE, Adibi P et al. Iranian Registry of Crohn's and Colitis: study profile of first nation-wide inflammatory bowel disease registry in Middle East. *Intest Res* 2019;17(3):330-9. doi: 10.5217/ir.2018.00157.
171. Choi K, Chun J, Han K, Park S, Soh H, Kim J, Lee J, Lee HJ, Im JP, Kim JS. Risk of Anxiety and Depression in Patients with Inflammatory Bowel Disease: A Nationwide, Population-Based Study. *J Clin Med* 2019;8(5). pii: E654. doi: 10.3390/jcm8050654.
172. Panhwar MS, Mansoor E, Al-Kindi SG, Sinh P, Katz J, Oliveira GH, Cooper GS, Ginwalla M. Risk of myocardial infarction in inflammatory bowel disease: A population-based national study. *Inflamm Bowel Dis* 2019;25(6):1080-7. doi: 10.1093/ibd/izy354.
173. Kuenzig ME, Bishay K, Leigh R, Kaplan GG, Benchimol EI; Crowdscreen SR Review Team. Co-occurrence of Asthma and the Inflammatory Bowel Diseases: A Systematic Review and Meta-analysis. *Clin Transl Gastroenterol* 2018;9(9):188. doi: 10.1038/s41424-018-0054-z.
174. Vutcovici M, Brassard P, Bitton A. Inflammatory bowel disease and airway diseases. *World J Gastroenterol* 2016;22(34):7735-41. doi: 10.3748/wjg.v22.i34.7735.
175. Kelly OB, Li N, Smith M, Chan J, Inman RD, Silverberg MS. The Prevalence and Clinical Associations of Subclinical Sacroiliitis in Inflammatory Bowel Disease. *Inflamm Bowel Dis* 2019;25(6):1066-71. doi: 10.1093/ibd/izy339.
176. Scharl S, Barthel C, Rossel JB, Biedermann L, Misselwitz B, Schoepfer AM et al. Malignancies in Inflammatory Bowel Disease: Frequency, Incidence and Risk Factors-Results from the Swiss IBD Cohort Study. *Am J Gastroenterol* 2019;114(1):116-26. doi: 10.1038/s41395-018-0360-9.
177. Waters BM, Jensen L, Fedorak RN. Effects of formal education for patients with inflammatory bowel disease: a randomized controlled trial. *Can J Gastroenterol* 2005;19(4):235-44.
178. Ashok K, Mathew AA, Thomas A, Mohan D, Gopalakrishna R, Reghu R. Clinical Pharmacist's Interventions on Medication Adherence and Knowledge of Inflammatory Bowel Disease Patients. *J Young Pharm* 2017;9(3):381-5. doi:10.5530/jyp.2017.9.76
179. Tiao DK, Chan W, Jeganathan J, Chan JT, Perry J, Selinger CP et al. Inflammatory Bowel Disease Pharmacist Adherence Counseling Improves Medication Adherence in Crohn's

- Disease and Ulcerative Colitis. *Inflamm Bowel Dis* 2017;23(8):1257-61. doi: 10.1097/MIB.0000000000001194.
180. McDowell C, Haseeb M. Inflammatory Bowel Disease (IBD) [Updated 2019 Jan 2]. In: StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2019 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470312/>
181. Jones ASC. Optimising therapy for inflammatory bowel disease. *Clinical Pharmacist*, 20 November, 2014.
182. Steel A, Morgan H, Tan W. PTU-140 Does a dedicated inflammatory bowel disease (IBD) pharmacist clinic improve patient safety? *Gut* 2018;67:A265-A266.
183. Bhat S. The Pharmacist's Role in Biologic Management for IBD in a Health System—Integrated Practice Model. *Pharmacy Times*, 23 October, 2015.