

**Journal of Pharmaceutical Advanced Research****(An International Multidisciplinary Peer Review Open Access monthly Journal)**Available online at: [www.jparonline.com](http://www.jparonline.com)**Clinical Pharmacists in Chronic care [Part 1]****Abdul Kader Mohiuddin**

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**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.

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**INTRODUCTION:**

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

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with greatly expanding clinical pharmacy faculty in Colleges of Pharmacy <sup>141</sup>. Pharmacy education debated where clinical pharmacy fit within pharmacy training. The American Association of Colleges of Pharmacy (AACCP) 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>145</sup>. Accreditation Council for Pharmacy Education (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>161</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>171</sup>. The concept of pharmaceutical care emphasizes the pharmacists' responsibility to pursue the best possible patient outcomes of medication therapy <sup>181</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>191</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>110</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>111</sup>. Their functions encompass comprehensive medication management (i.e. prescribing, monitoring, and adjustment of medications), non-pharmacologic 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>112</sup>. Pharmacists may manage chronic or acute illnesses associated with endocrine, cardiovascular, respiratory, gastrointestinal, or other systems <sup>113</sup>. Clinical pharmacist researchers

generate, disseminate, and apply new knowledge that contributes to improved health and quality of life <sup>114</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>115</sup>. Clinical pharmacists are a primary source of scientifically valid information and advice regarding the safe, appropriate, and cost-effective use of medications <sup>116</sup>. They obtain medical and medication history, check medication errors including prescription, dispensing and administration errors, identify drug interactions, monitor adverse drug reaction (ADR), suggest individualization of dosage regimen and provide patient counseling <sup>117</sup>. They also provide information about the use of drugs and medical devices like inhaler, insulin pen, eye drops and nasal sprays <sup>118</sup>. Participation of a clinical pharmacist in ward/ICU rounds and clinical discussions helps to identify, prevent or reduce drug interaction and ADR <sup>119</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.**

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>[20]</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>[21]</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>[22]</sup>. To increase the safety and effectiveness of treatment, these patients must have specific needs met, with regards to appropriate medication use<sup>[23]</sup>. Studies have shown that integrating pharmacists into ambulatory clinics can improve chronic disease management and optimal use of medications<sup>[24]</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>[25]</sup>. Compared to usual care, pharmacist-led care was associated with similar incidences or rates of office, urgent care 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>[26]</sup>. Another recent study shows tele-health 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 lipid management and tobacco cessation<sup>[27]</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 Diabetes mellitus (DM) is about 425 million people, of whom 279 million are in urban areas and 146 million are in rural zones<sup>[28]</sup>. The International Diabetes Federation (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>[29]</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>[30]</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>[31]</sup>. It is a risk factor for cardiovascular disease (CVD) and has been associated with 2- to 4-fold higher mortality<sup>[32]</sup> and another study says that half of all diabetic death was due to CVD<sup>[33]</sup>. The number of deaths caused by diabetes in the age range of 60 to 99 years in 2017 was 3,200,000<sup>[34]</sup>. About half of diabetes-related mortality (48 %) occurs in people younger than 60 years and it continues to reduce life expectancy by 6 to 8 years in people diagnosed at the age of 50 years<sup>[35]</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>[36]</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>[37]</sup>. Management of DM remains a significant challenge in the US, as estimates indicate that greater than 40 % of diabetes patients are uncontrolled with an 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>[38]</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>[39]</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>[40]</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>[41]</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>[42]</sup>.

#### **CVD Prevention:**

Hypertension is the single most important risk factor for CVD and a key driver of global disease burden <sup>[44]</sup>. It is a major risk factor for coronary heart disease (CHD), stroke, retinopathies, and renal dysfunction. 18 million people die each year from CVDs, an estimated 31 % of all deaths worldwide <sup>[45]</sup>. Of these deaths, 85 % are due to MI and stroke <sup>[46]</sup>. CVD is currently the leading cause of morbidity and mortality and over 80 % occur in LMICs <sup>[47]</sup>. Nearly 50 % patients with chest pain related to exercise have obstructive coronary artery disease <sup>[48]</sup>. Coronary artery spasm plays an important role in the pathogenesis of ischemic heart disease (IHD), including angina pectoris, myocardial infarction (MI), and sudden death, occurring most often from midnight to early morning <sup>[49]</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 non-adherent <sup>[50]</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, hypercholesterolemia and high BMI, are among the most important contributors to Disability-Adjusted Life Year (DALYs) <sup>[51]</sup>. CVD claimed death of some 900,000 death in US in 2016 <sup>[52]</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>[53]</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>[54]</sup>. The goals of treatment of hypertension are to limit target organ damage, thereby reducing the morbidity and mortality associated with the disease <sup>[55]</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>[56]</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>[57]</sup>. Surprisingly, 60 to 80 % of the population around the world (according to WHO) are partially or fully dependent upon herbal drugs for primary healthcare <sup>[58]</sup>. Interactions of some ingredients in supplements with other anti-hypertensive and cardiovascular preparations are well-documented. Green tea showed 85 % decrease in plasma concentration of nadolol, for example <sup>[59]</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 (e.g. blood pressure, blood glucose, serum lipids) and clinical outcomes <sup>[60]</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

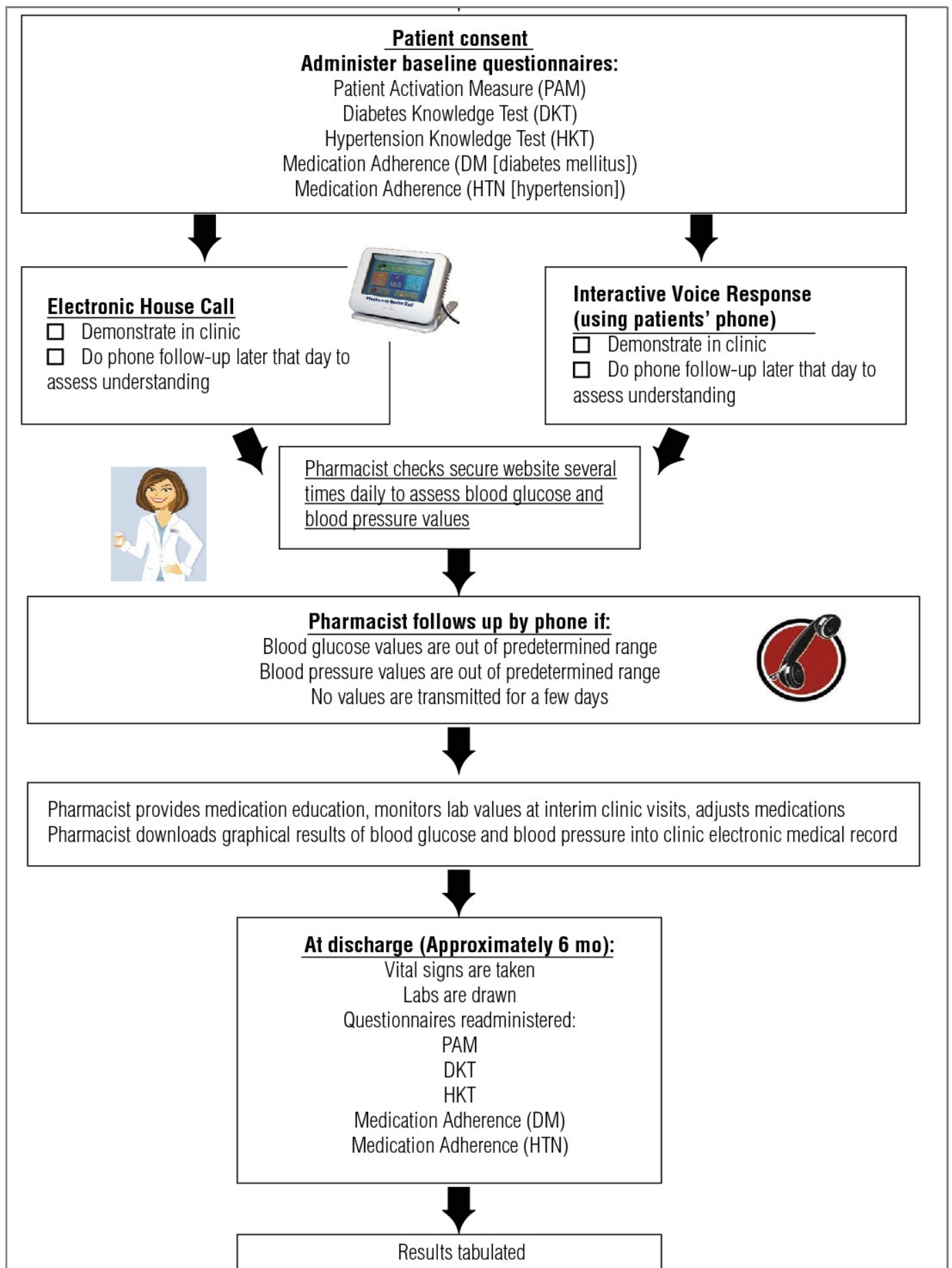


Fig 2. Telemonitoring model for providing clinical pharmacy services to patients with diabetes <sup>[43]</sup>.

patient quality of life (QoL) by reducing Blood Pressure levels in patients treated with antihypertensive agents, increased referral acceptance <sup>161</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. Weight loss has been noted to modify risk factors via improving insulin sensitivity, reducing inflammation, decreasing blood pressure and modifying the lipid profile <sup>162</sup>. It is astonishing that 7 to 28 % of patients with coronary heart disease still smoke, but around half of smokers are planning to quit <sup>163</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>164</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. Prescription smoking cessation medications include bupropion and varenicline. A recent Canadian survey shows that pharmacist-led intervention resulted in more than 70 % of patients using nicotine replacement therapy for smoking cessation <sup>165</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. 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>167</sup>. Globally, the annual cost of obesity-related diseases has reached \$2 trillion according to a recent report by McKinsey Global Institute. Obesity increases cardiovascular risk through risk factors such as increased fasting plasma triglycerides, high low density lipoprotein (LDL) cholesterol, low high density lipoprotein (HDL) cholesterol, elevated blood glucose and insulin levels and high blood pressure <sup>168</sup>. Also, obesity causes cerebral vasculopathy, gallbladder lithiasis, arthropathy, ovarian polycytosis, sleep apnea syndrome, and some neoplasms. Successful obesity treatment plans incorporate diet, exercise, behavior modification (with or without drug treatment), and/or surgical intervention <sup>169</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>170</sup>. If secondary causes are suspected, then a more complete diagnostic workup and appropriate therapy is important. The clinician should then 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, Gastroesophageal Reflux Disease (GERD), hypertension, and polycystic ovarian syndrome (PCOS) <sup>171</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>172</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>174</sup>. As pharmacists currently do not have a well-identified role in obesity management, but study results display that pharmacist intervention was beneficial <sup>175</sup>. According to Canadian Pharmacists Journal, 2016 pharmacist prescribing resulted in >3-fold more patients achieving target LDL-c levels <sup>176</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. Studies have demonstrated that pharmacist-led interventions, including lipid clinics, can help patients achieve these more aggressive goals <sup>177</sup>.

#### **Asthma and COPD management:**

Asthma and chronic obstructive pulmonary disease (COPD) are common chronic conditions that comprise nearly 80 % of direct health care costs associated with respiratory diseases in the EU <sup>178</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>179</sup>.

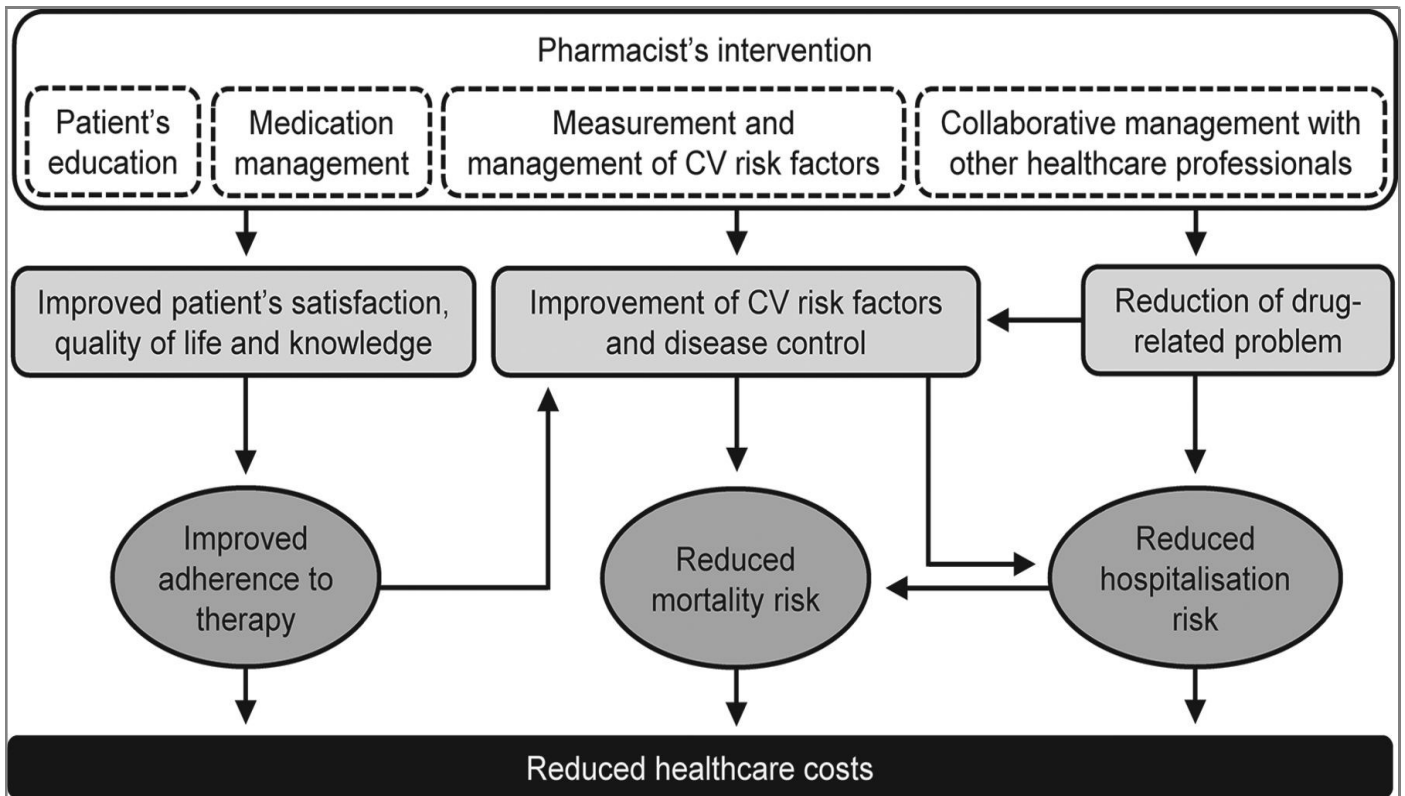


Fig 3. Effects of pharmacist's intervention on humanistic, clinical and economic outcomes in patients with cardiovascular diseases [66].

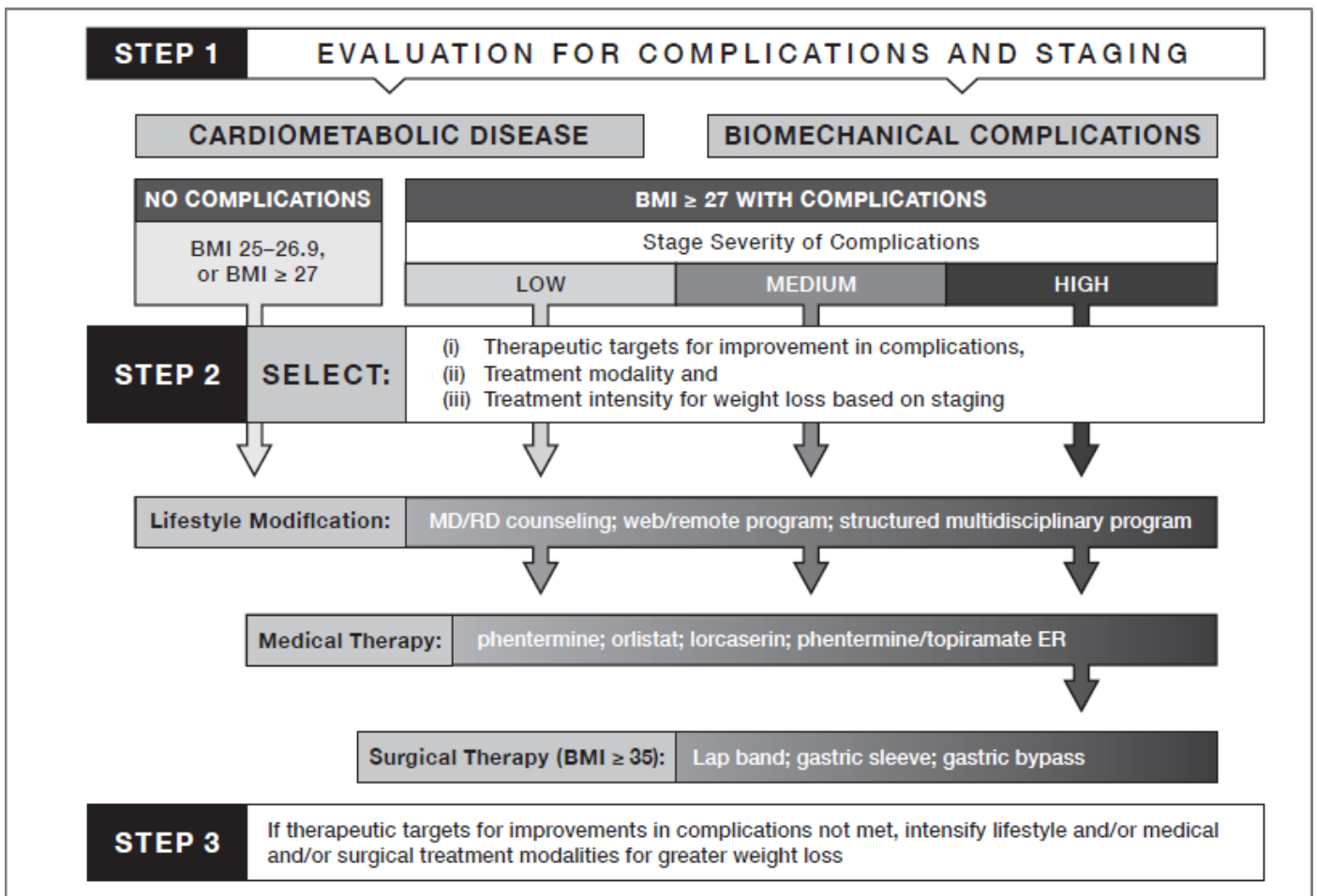


Fig 4. 2013 ACE Obesity Treatment Algorithm [73].

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>[80]</sup>. In 2015 alone, the death toll due to asthma was 383,000 globally. One in five individuals with a diagnosis of COPD, asthma, or both asthma and COPD in primary care settings have asthma-COPD overlap<sup>[81]</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>[82]</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. Adherence to inhaled medication is poor in the real world and shows great variability, ranging from as low as 20 % to over 60 %<sup>[83]</sup>.

To improve adherence, the therapeutic decisions should be discussed with the patient and should take into consideration their lifestyle factors, demographic characteristics (age, co-morbidities, physical limitations, psychological and cognitive status), and pharmacological factors (polypharmacy regimens) to choose the best inhaler device for that patient. Pharmacist-led comprehensive therapeutic interchange program of COPD inhalers may provide 30 % 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>[84]</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>[85]</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>[86]</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

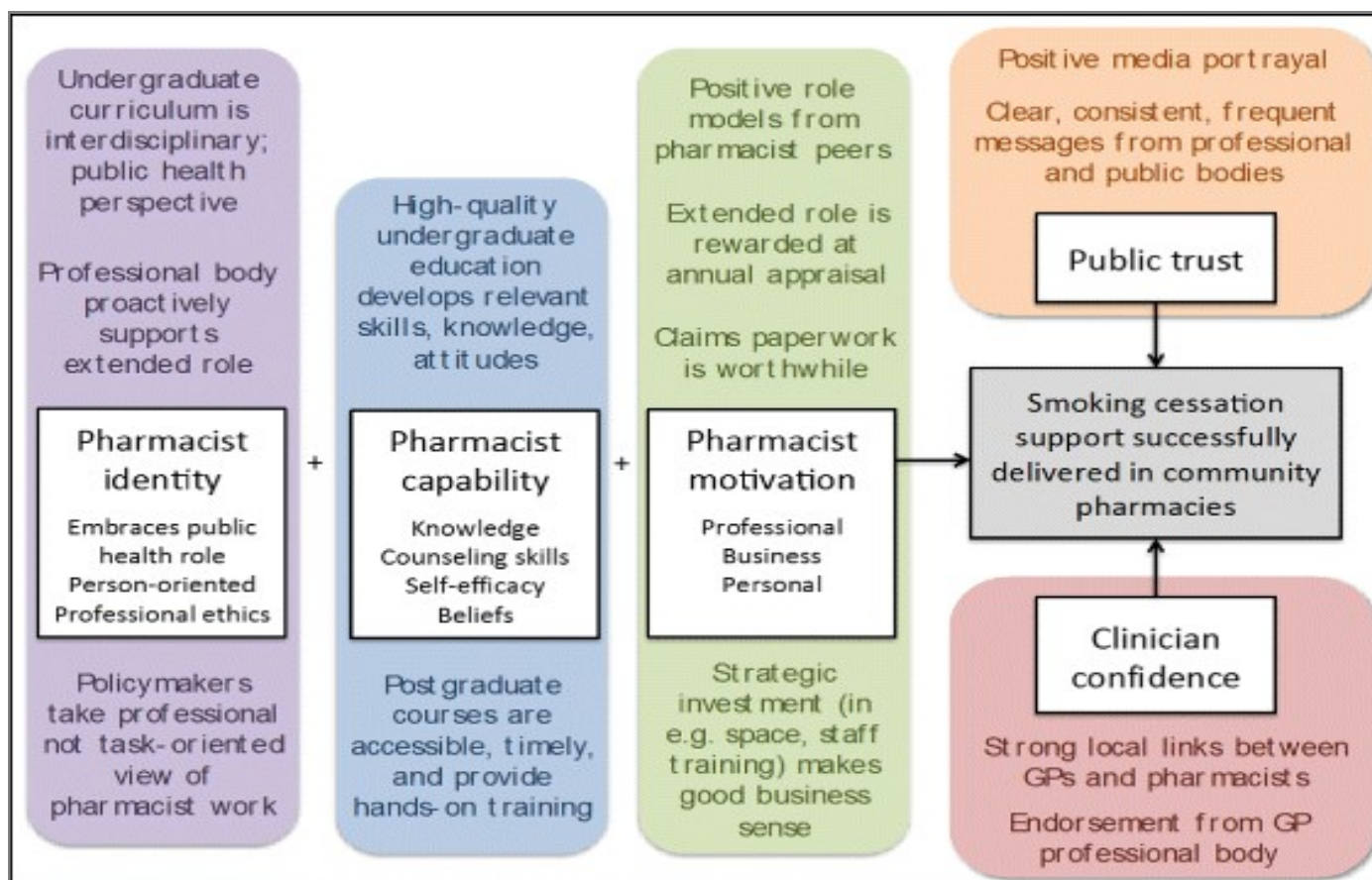
medication-related side effects<sup>[87]</sup>. Step up of therapy comprised increasing or starting corticosteroid/long-acting beta agonist combination inhaler; corticosteroid inhaler; short-acting muscarinic antagonist inhaler; oral corticosteroid; oral montelukast; or long-acting muscarinic antagonist 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>[88]</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. 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>[89]</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. 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>[91]</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>[92]</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 pharmacotherapy is suboptimal<sup>[93]</sup>. Nearly 50 % osteoporosis patients are non-adherent to medications. Furthermore,



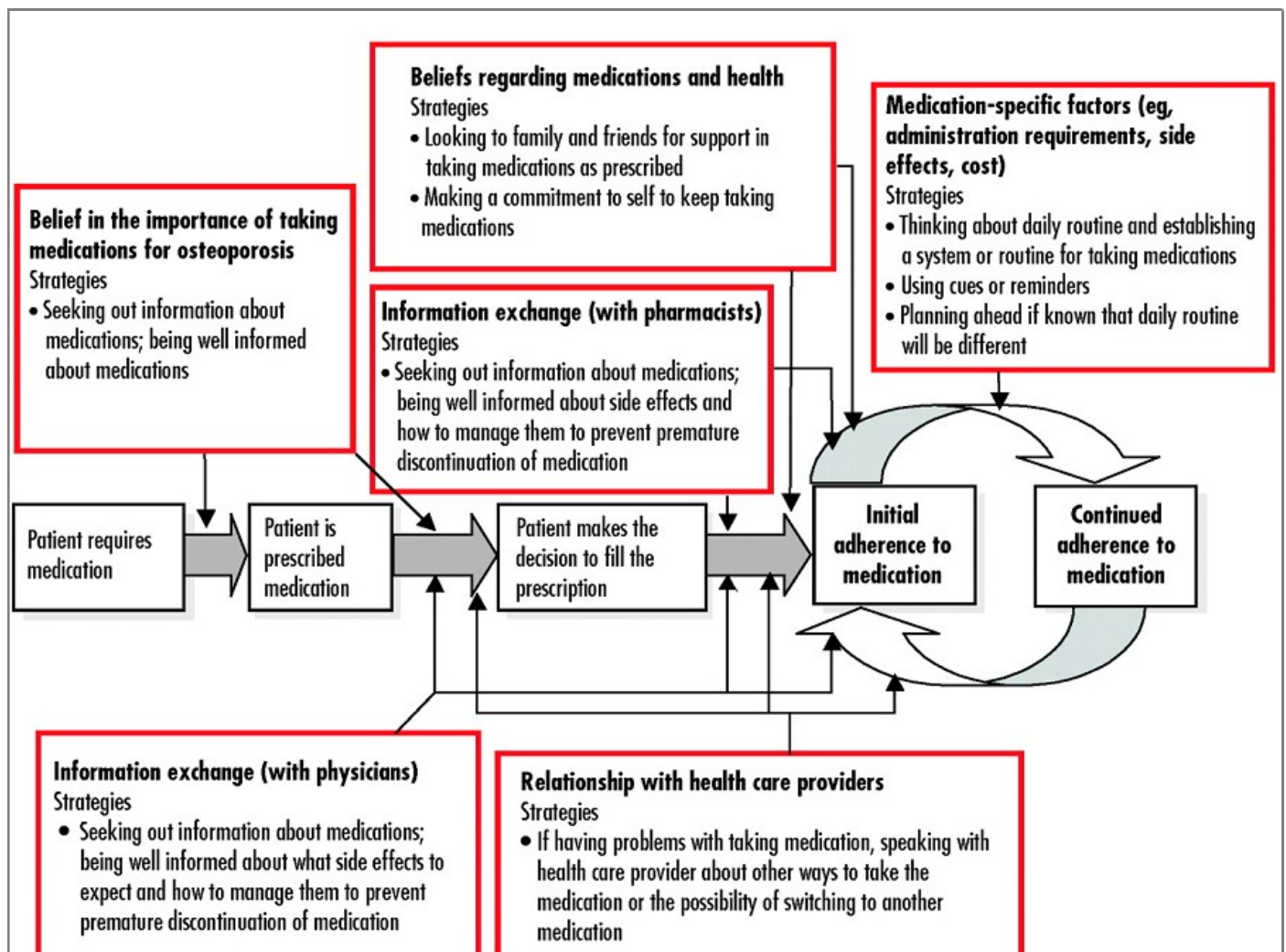


**Fig 5. Unifying model showing key influences on successful delivery of smoking cessation support by pharmacists<sup>[90]</sup>.**

approximately 50 to 70 % of the patients discontinue their osteoporosis medications within the first year of initiation, which results in increased morbidity and mortality. 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>[94]</sup>.

High patient cost and safety concerns are barriers for nearly 60 % patients. 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>[96]</sup>. Treatment strategies of osteoporosis include non-pharmacological treatment - diet rich of calcium and vitamin D, healthy lifestyle, proper exercise plan, and pharmacological therapy. Bone-Mineral Density (BMD) monitoring after initiating anti-osteoporosis therapy in the routine clinical practice setting<sup>[97]</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>[98]</sup>. Hormone replacement therapy (HRT) is not first-line therapy position for osteoporosis, but is best for prevention of osteoporosis<sup>[99]</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. Pharmacist-physician collaboration is associated with higher treatment rates of osteoporosis<sup>[100]</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>[101]</sup>.



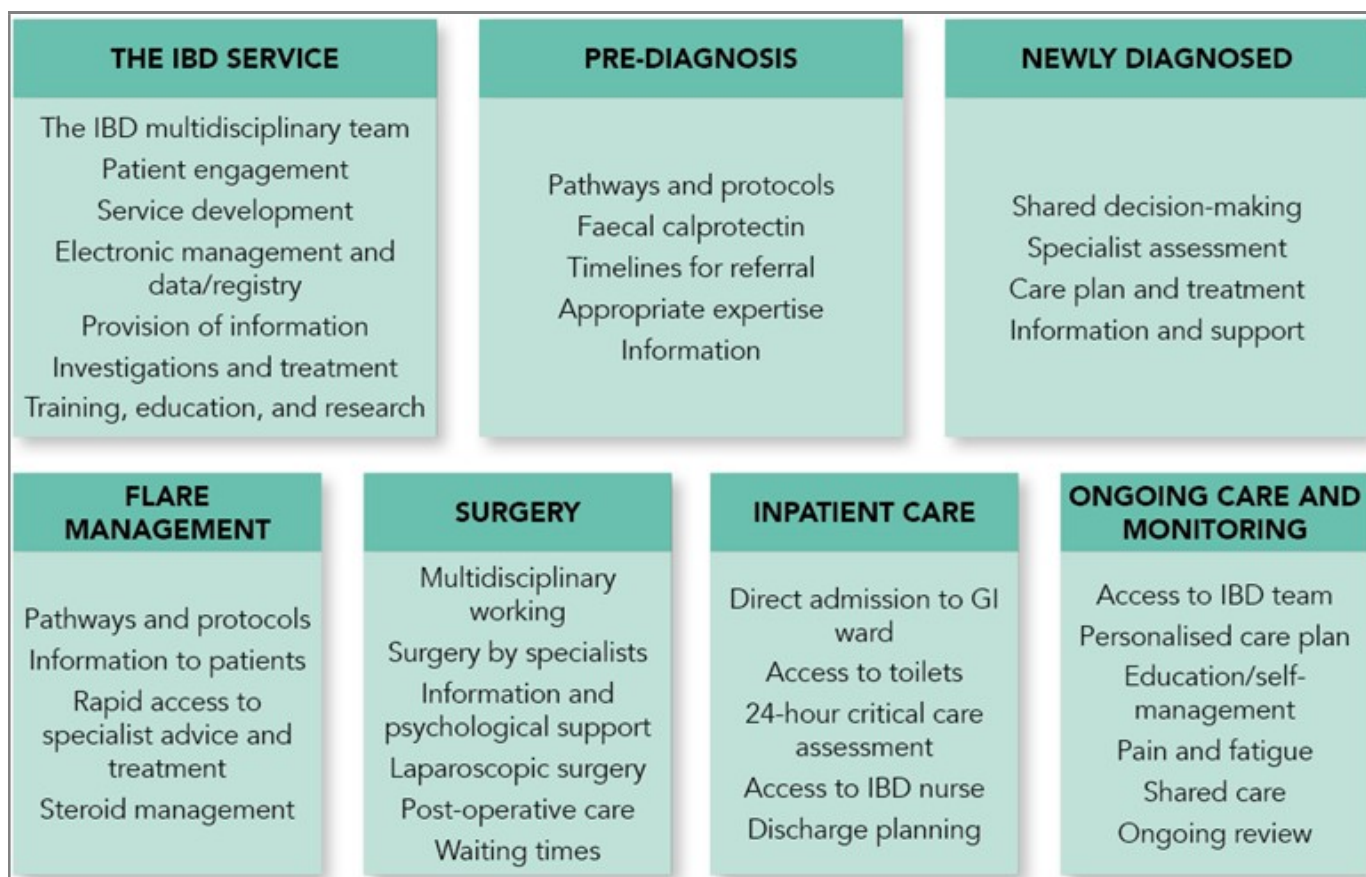
**Fig 6. Mapping the factors influencing adherence and adherence strategies onto the medication-taking process in patients with osteoporosis [95].**

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 topic vaginal creams for positive patient compliance and adherence to therapy [102].

**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 [103]. 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 [104]. 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. A total of about 66,000 US residents with a new IBD diagnosis each year, since 2015 [105]. 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. 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. IBD is a relapsing–remitting condition that causes inflammation and ulceration in the bowels, affecting approximately 500,000 people in the UK [106].



**Fig 7. The seven sections of the 2019 IBD Standards** <sup>[107]</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>[108]</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. Anxiety and depression are the most common psychological disorders in patients with IBD. IBD is associated with significantly increased MI compared with non-IBD patients. Patients with IBD are also at risk for asthma or COPD and bronchiectasis <sup>[108]</sup>. Sacroiliitis, an inflammatory arthropathy associated with ankylosing spondylitis, is found in patients with IBD but may go undiagnosed. IBD patients showed increased risk for lymphoma and biliary cancer <sup>[109]</sup>. The general goals of treatment are to induce and maintain remission, minimize complications and disease manifestations, and improve 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>[110]</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. Medication non adherence 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>[110]</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. Pharmacist-led drug monitoring clinics measure thioguanine nucleotides and thiopurine methyltransferase levels four weeks after treatment with thiopurines is started to optimize outcomes. 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 [111]. 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. 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 [112].

#### 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 Drug Related Problems (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 of 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.

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