

# Pharmacy-Led Management of Atrial Fibrillation: Improving Treatment Adherence and Patient Outcomes

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**Abstract:** The world's population is ageing, with the number of those over 60 years expected to represent a fifth of the total population by 2050. Increases in chronic long-term health conditions (LTCs) associated with ageing, and requiring regular but often avoidable medical intervention, are pressurising already overloaded, health and social care systems. Atrial fibrillation (AF) is an LTC, which is most frequently diagnosed in the elderly. An often, asymptomatic condition, AF is associated with a 3- to 5-fold increased risk of severe ischemic stroke. Stroke prevention, with risk-stratified oral anticoagulants (OACs) is the standard recommended care for patients with AF. Stroke avoidance is, however, dependent on persistent adherence to OAC medication, with an adherence rate of >80% considered necessary to achieve optimal health outcomes. Suboptimal adherence to OACs is common, with a third of all AF patients not taking their medication as prescribed. This combined with the short half-life of OACs can result in poor clinical outcomes for patients. Policy makers now consider improving adherence to prescribed medicines for LTCs, a public health priority, to ensure better health outcomes for patients, whilst minimising unnecessary health system costs. Prescribing medicines to treat LTCs, such as AF, is not enough, particularly when the patient may not experience any measurable benefit to the treatment and may instead, experience medication-associated adverse events, including a risk of bleeding. Pharmacists who are experts in medicines management are ideally placed to support medication adherence, to educate, and to improve health outcomes for patients with AF. In this review, I will consider the evidence for poor medication adherence in LTCs and in particular adherence to OACs in patients with AF and highlight the role that pharmacists can play in ensuring optimal adherence and showcase pharmacist-led interventions that effectively address this problem.

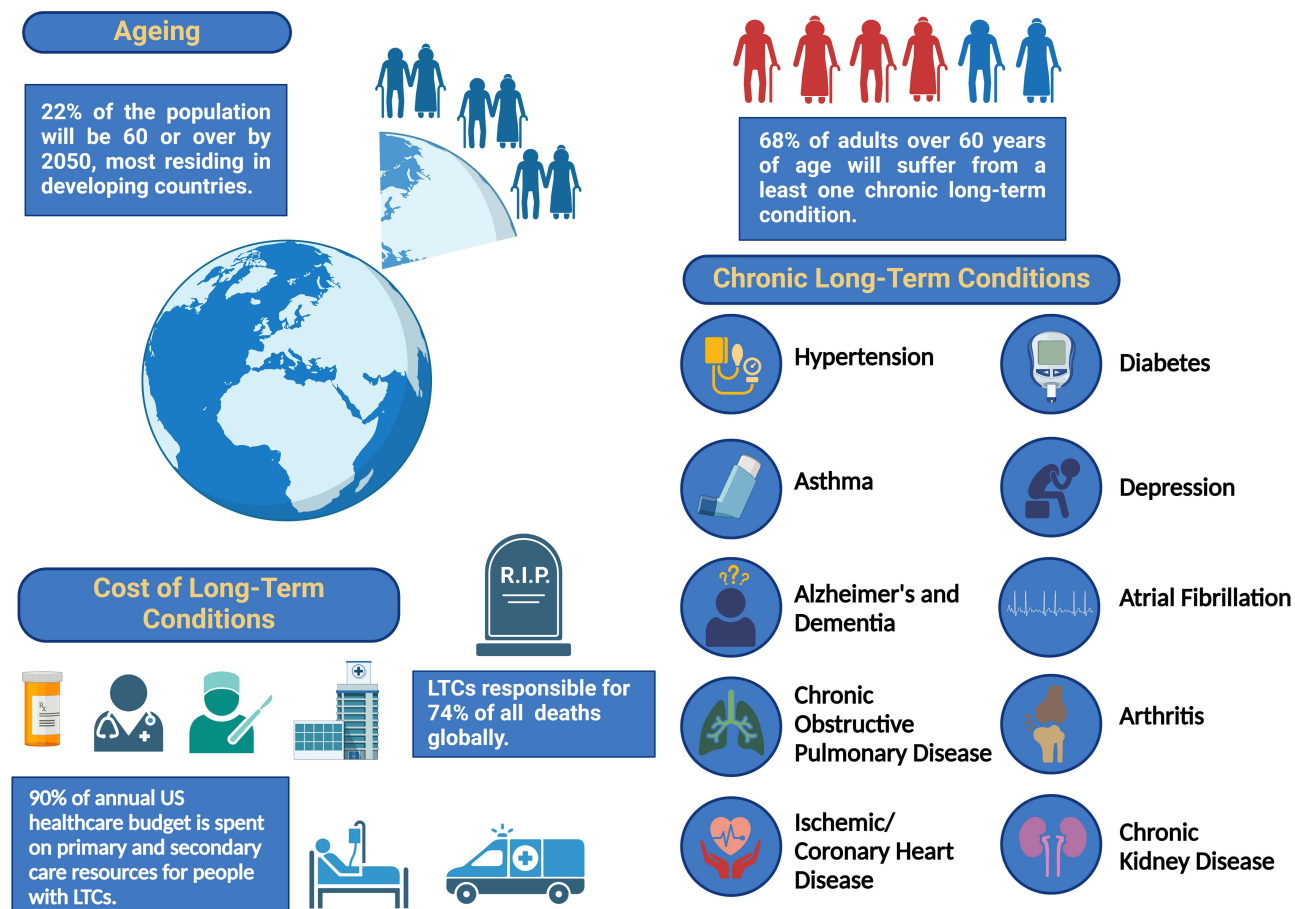
**Keywords:** atrial fibrillation, oral anticoagulants, pharmacists, medication adherence, stroke, long-term conditions

## Introduction

### Ageing and Chronic Long-Term Conditions

The world's population is ageing. The global life expectancy is now estimated at 72.3 years, rising to over 80 years in developed countries.<sup>1,2</sup> In 2050, it is predicted that a fifth of the population worldwide will be aged 60 years and older, with 400 million of those being 80 years or older, and residing mainly in low- to middle-income countries.<sup>3</sup> Longer life expectancy, however, can more often than not coincide with a growing risk of developing chronic long-term disease conditions (LTCs) and as a consequence experiencing a deleterious decline in physical and mental capacity (Figure 1).<sup>4</sup>

In 2020, “The UN Decade of Healthy Ageing” was proclaimed by the World Health Organization (WHO) and the United Nations (UN). Its purpose to develop strategies, as a global multisectoral collaboration, to promote healthy ageing in older people.<sup>5,6</sup> Chronic LTCs, such as diabetes, hypertension, chronic obstructive pulmonary disease, chronic kidney disease, ischemic/cardiovascular disease, osteoarthritis, asthma, depression, atrial fibrillation, Alzheimer's and dementia, which are managed with drugs and therapies, are more prevalent in the older population. Almost two thirds of people suffering from chronic, LTCs will be over 60 years old, compared to only 14% in those under the age of 40.<sup>4</sup> As well as increasing the prevalence of LTCs, age also increases the number, with 25% of the over 60's suffering from two or more



**Figure 1** Relationship between ageing and chronic long-term conditions. Created with BioRender.com.  
**Abbreviation:** LTC, Long-term condition.

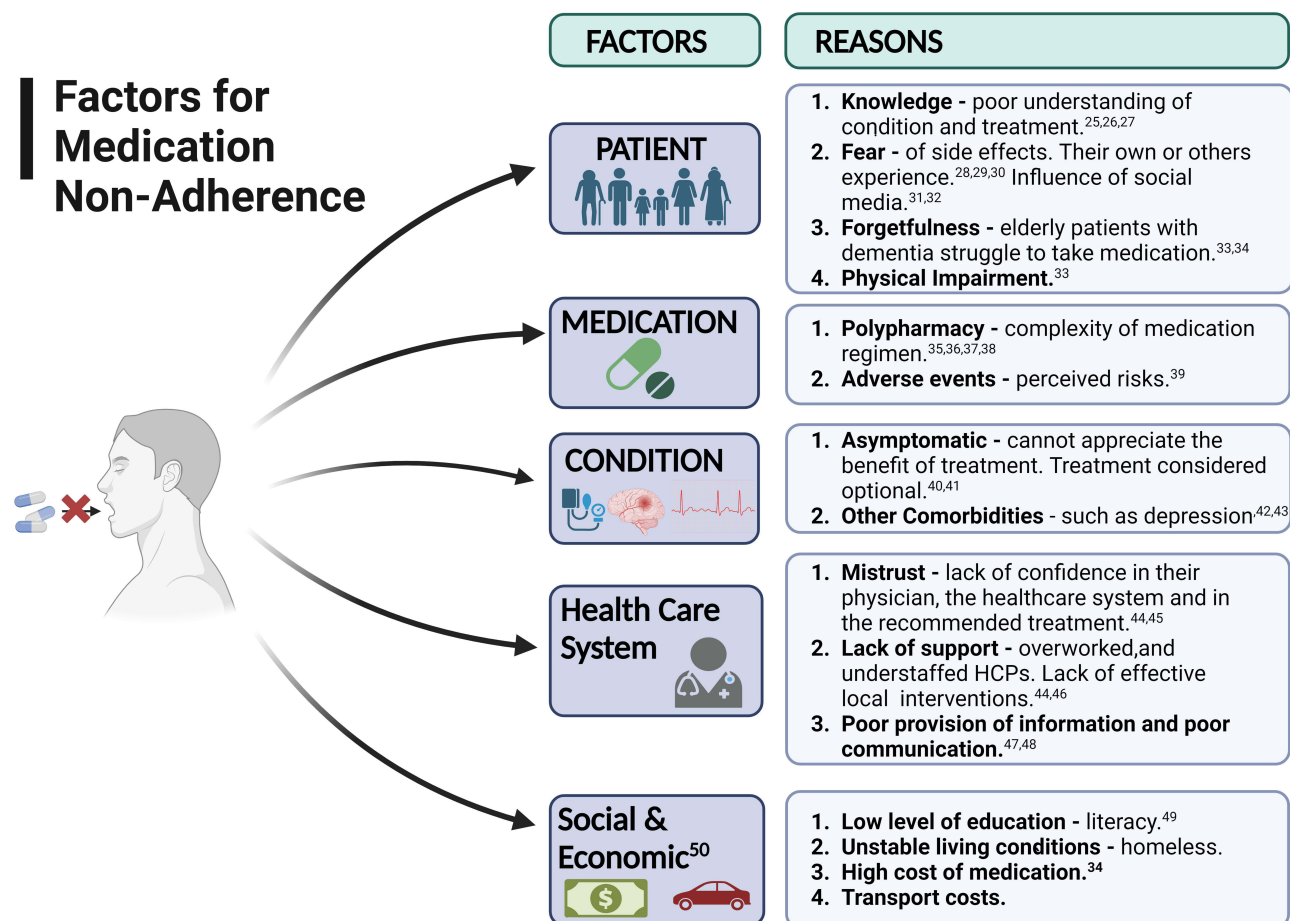
LTCs.<sup>4</sup> In addition to age, lifestyle is also another major risk factor in developing LTCs, with those from disadvantaged communities with a poorer quality of life, having the likelihood of developing multiple LTCs, 10–15 years earlier than those living in affluent areas.<sup>7</sup> Chronic LTCs are responsible for 74% of all deaths globally, with over three-quarters of these occurring in low- and middle-income countries.<sup>8</sup> People with LTCs are intensive users of health and social care, with the average cost for treatment of an LTC being much higher than for those without one. It is estimated for every £10 of the UK healthcare budget, £7 is spent on people with LTCs, due to the concomitant demands on primary and secondary care resources,<sup>4</sup> whilst in the US, 90% of the annual healthcare budget is spent on chronic LTCs.<sup>9</sup> For the patient, LTCs can mean managing complex health regimes and adhering to prescribed medicines, every day, often for the duration of their life.

## Medication Adherence

Adherence to medicines can be described simply as taking a prescribed medicine, at the right time, in the right way and at the recommended frequency.<sup>10</sup> Medications in LTCs and particularly in the elderly are prescribed to mitigate disease, extend life-expectancy, and improve quality of life. Despite the proven efficacy of medications for treating LTCs, the full benefits to the patient are often not realised, with approximately 50% of the patients not taking their long-term medications as prescribed<sup>10</sup> when typically taking medication for all (100%) or for most of the time (>80%) is required to achieve optimal therapeutic efficacy.<sup>11</sup> This 80% adherent cut off point, however, is not without ambiguity, with the evidence for cardiovascular disease (CVD) suggesting a much higher cut-off rate being required to ensure good health outcomes.<sup>12,13</sup> None or partial adherence to medications (<80%) has been shown to correlate with poor health outcomes, particularly in the elderly population, for whom the risk of hospitalisation, nursing home admission, and mortality

increases.<sup>14,15</sup> Non- or low adherence is not just a clinical problem, however, but is associated with huge economic costs, due to increased healthcare resource usage. Billions are lost annually in wasted medication prescriptions and avoidable inpatient and outpatient healthcare costs,<sup>16,17</sup> not to mention, in the European Union, almost 200,000 preventable deaths every year.<sup>18,19</sup> The elderly in particular are huge consumers of prescription medications and for whom non-adherence is common.<sup>20</sup> This population alone accounts for 61.6% of all prescribed medicines in the UK.<sup>21</sup> There is a myriad of reasons for non-adherence in this particular population and not all can be attributed solely to the patient but instead a complex network involving the patient, the prescriber, and the healthcare system.<sup>10</sup> Interestingly, but perhaps not surprisingly, most medication non-adherence is intentional,<sup>22,23</sup> with patients actively making a conscious decision, either from prior knowledge, experience, or beliefs, not to take their medicine as prescribed.<sup>24</sup> Reasons for non-adherence can be related to a number of factors and not always in isolation. The World Health Organisation identified five interacting factors of adherence:<sup>10</sup> Patient-related; Medication-related; Condition-related; Health-care system-related; Social- and economic-related (Figure 2).

Taking these reasons for medication non-adherence into account when designing interventions to overcome them, is thought to improve the likelihood of patient adherence.<sup>30</sup> In addition, it is reported that effective interventions have to involve sustained behavioural changes such as changing misguided beliefs about the medication, improving patient-provider relationships, designing acceptable regimens, and focusing on self-management.<sup>46,51</sup> Policy makers, healthcare managers, and healthcare professionals (HCPs) have realised that improving patients' adherence to their medication is a public health issue and key to improving patient clinical outcomes, reducing medication waste, and improving the financial sustainability of healthcare systems and stretched medical resources.<sup>52</sup> This and the WHO's statement that



**Figure 2** Factors identified for medication non-adherence. Created with BioRender.com.

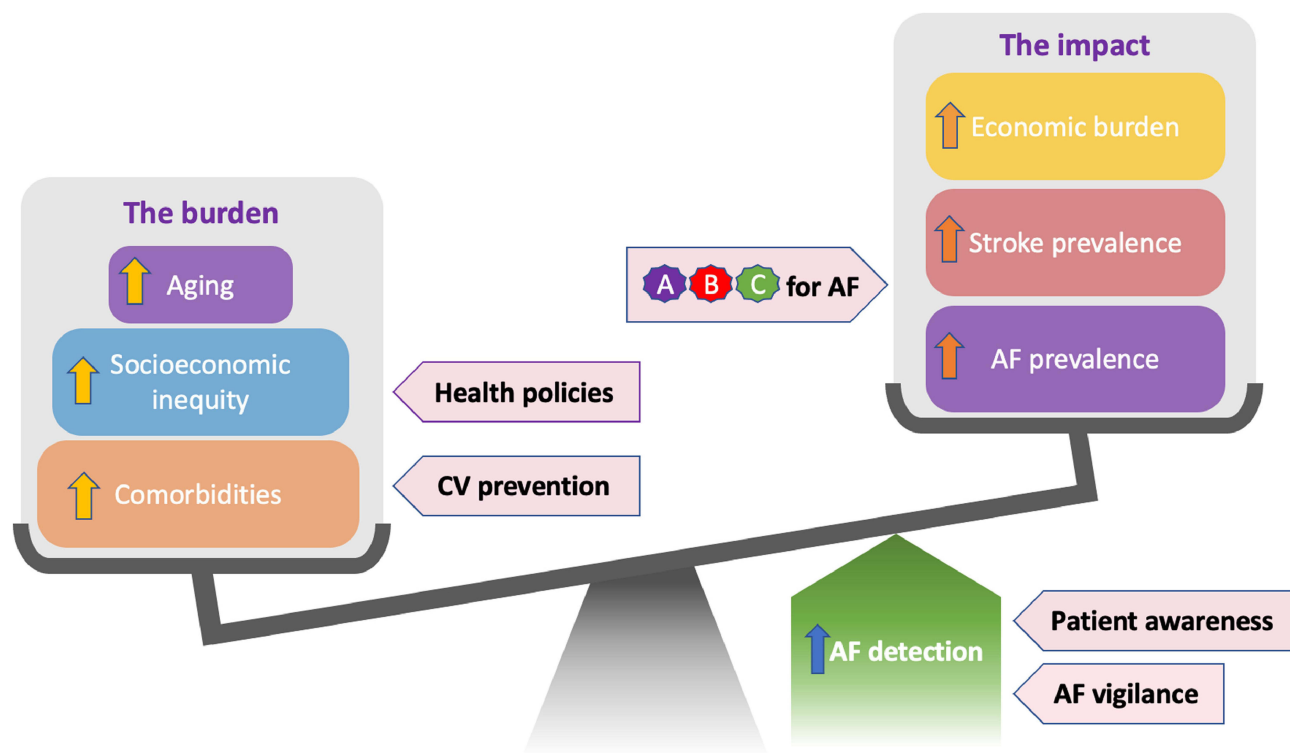
**Abbreviation:** HCP, healthcare professional.

“increasing the effectiveness of adherence may have far greater impact on the health of the population than any improvement in specific medical treatments”<sup>10</sup> has meant that adherence is now a key component of several European Union (EU) policies, including legislation of pharmacovigilance,<sup>53</sup> health literacy; patient safety and quality of care; and the European innovation partnership on Healthy and Active Ageing.<sup>54</sup>

The aim of this review is to focus on aspects of medication adherence for one chronic LTC, atrial fibrillation, examining known determinants of patient adherence and non-adherence to oral anticoagulant therapy, required to mitigate the risk of stroke. Additionally, the review will showcase some reported examples of pharmacist-led interventions aimed at improving anticoagulant adherence and clinical outcomes for patients with AF, in order to highlight opportunities that can be adopted to improve OAC management and patient care.

### Atrial Fibrillation

Atrial Fibrillation (AF) is the most commonly diagnosed cardiac dysrhythmia<sup>55</sup> and with the highest risk (3- to 5-fold) for the occurrence of severe ischemic stroke (IS).<sup>56–58</sup> Advancing age is the most notable, non-modifiable risk factor for the development of AF with the incidence of AF, doubling with each decade, after the age of 60.<sup>57</sup> AF has a prevalence of >10% (versus 2.5% in the overall population) reported for those over 80 years of age,<sup>57,59–62</sup> increasing to as high as 38%, for those residents of care and nursing homes, where advanced age residents suffering from multiple LTCs, are concentrated.<sup>63–67</sup> This disproportional increase in AF prevalence in older aged adults is aligned with a concomitant increase in the incidence of IS (23.5% versus 1.8%).<sup>57,58,62,65</sup> With increasing global life expectancy and a concurrent increase in LTCs, the prevalence and incidence of AF will continue to rise, with the global burden of AF predicted to reach 62.5 million by 2050<sup>68</sup> and with that an elevated risk of life-threatening strokes and increased healthcare resource burden (Figure 3).



**Figure 3** Factors promoting adherence to OAC therapy in AF patients.  
**Notes:** Reprinted from *Lancet Reg Health Eur*, volume 17, Sagris D, Lip GYH. Atrial fibrillation, a contemporary sign of multimorbidity and irregular social inequity. 100395, copyright 2022, with permission from Elsevier.<sup>69</sup>  
**Abbreviations:** AF, atrial fibrillation.

## Oral Anticoagulants

Since their approval in the 1950's, although not routinely prescribed until the 1990's, oral anticoagulants (OACs) are considered one of the most effective and safe therapeutic strategies for reducing and preventing stroke in patients diagnosed with AF.<sup>70,71</sup> The superior effectiveness of vitamin K antagonists (VKAs), such as warfarin, to reduce stroke and mortality, when compared to then commonly prescribed anti-platelets, such as aspirin, were demonstrated in a series of randomised trials in the 1980's and 1990's.<sup>72–74</sup> Despite the obvious benefits of VKA therapy, these are also associated with some considerable risk of serious adverse events and therapeutic failures when not used properly, including a higher bleeding risk.<sup>73</sup> VKAs have a slow onset of action and narrow therapeutic index that requires careful monitoring to ensure that anticoagulation levels neither fall under or over the required therapeutic range, which can either increase the risk of IS or of an intracranial bleed, respectively.<sup>73,75</sup> The risk of bleeding whilst using anticoagulants is particularly notable in the elderly who are prone to syncope and falls, both as a consequence of older age and also of AF, which can increase the possibility of intracranial hematomas occurring.<sup>76–78</sup> Risk of falls in the elderly is one of the main reasons that OACs are not often prescribed by physicians or if prescribed, under-dosed to the extent that they are subtherapeutic.<sup>79–82</sup> Elderly people suffering with AF and a history of falls were found to be 17% less likely to be prescribed OACs than those with no prior falls.<sup>83</sup> Yet the current guidelines from the National Institute for Health Care Excellence (NICE) and the European Society of Cardiology (ESC) clearly state that OACs should not be withheld because of age or a risk of falls, as the benefit of stroke reduction, far outweighs the risk of intracranial haemorrhage.<sup>39,71,83</sup> It has been estimated that for the risk of bleeding to outweigh the benefit of taking OACs to prevent stroke, an elderly person would need to fall around 295 times a year, when the average an elderly person will fall is 1.81 times per year.<sup>84–86</sup> However, even for those correctly prescribed patients, the narrow therapeutic index of VKAs makes it difficult to maintain patients within the recommended international normalized ratio (INR) anticoagulation range, of 2.0–3.0. One large study found that in a large population of AF diagnosed individuals (6454) who were taking warfarin, their INR was outside of the desired 2.0–3.0 range, 50% of the time.<sup>87</sup> As well as requiring frequent monitoring and dose adjustments, to ensure appropriate INRs, VKAs also interact with other drugs and certain foods, which can increase bleeding risk and effectiveness, making for complicated therapeutic and dietary regimes for elderly patients, who are often taking many other medications.<sup>88,89</sup> These factors have been shown to be linked to reduced patient satisfaction with their OAC treatment<sup>90</sup> which in turn leads to inadequate adherence to VKAs and subsequently poorly anticoagulated patients.<sup>91</sup> In one study, adherence, defined as being greater than 80% was recorded in 51.2% of patients after one year of being prescribed VKAs, following an AF diagnosis.<sup>92</sup> Whilst persistence, defined as continuing to take medication after one year (whether adherent, >80% or non-adherent, <80%), was 63.4%.<sup>92</sup>

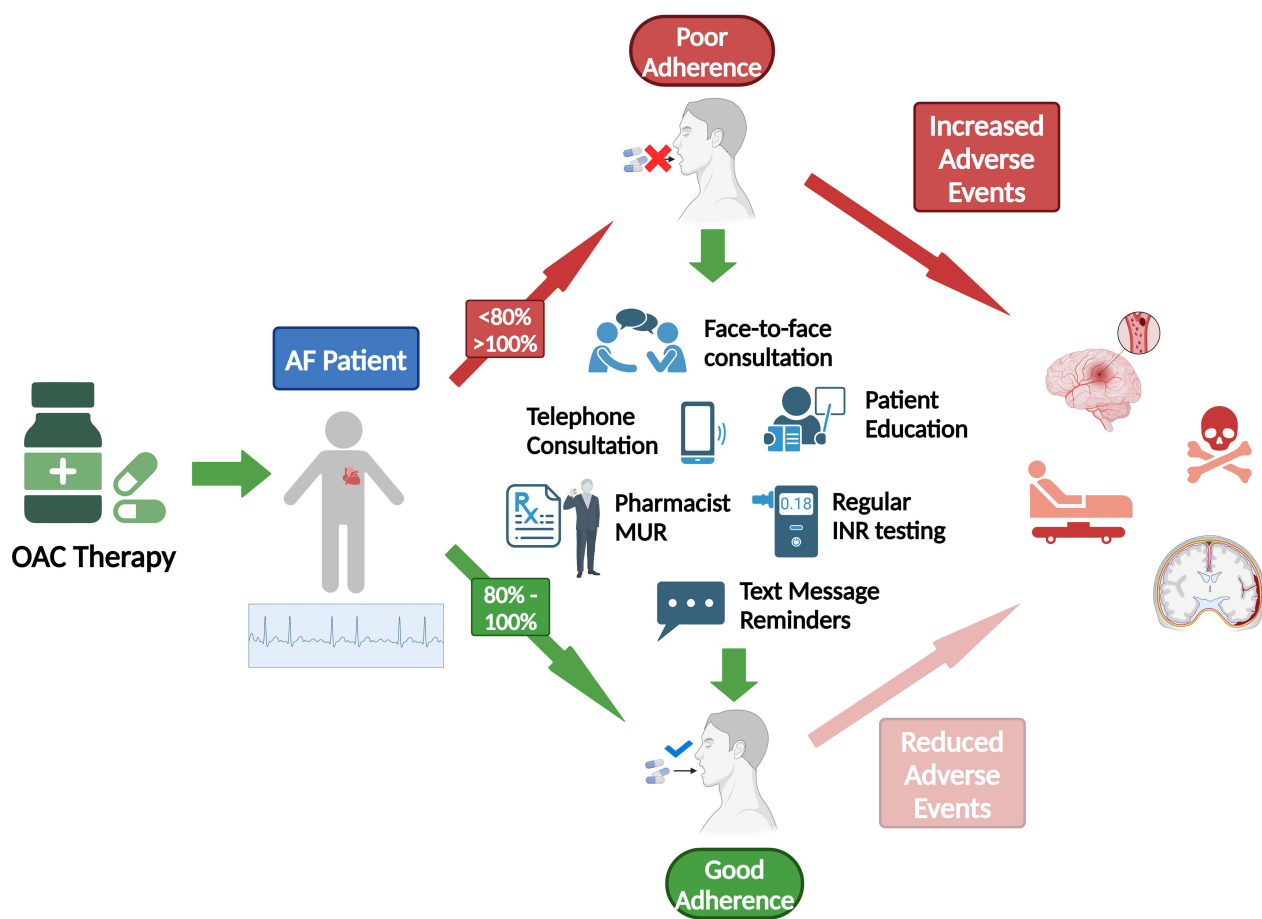
## Direct-Acting Oral Anticoagulants

The introduction of direct-acting oral anticoagulants (DOACs) following approval by the Food and Drug Administration (FDA) in 2010<sup>93</sup> and the European Medicine Agency (EMA) in 2012 heralded the possibility for improved adherence among nonvalvular AF patients.<sup>79</sup> Unlike VKAs, DOACs do not require continual monitoring of the INR, have less drug and dietary interactions, a 50% lower risk of intracranial haemorrhage and significant reduction in all-cause mortality.<sup>94–96</sup> Current guidelines recommend DOACs as first-line therapeutics for the prevention of stroke in nonvalvular AF patients.<sup>97–100</sup> Worldwide the number of AF patients reported as using OACs has doubled due to the increased prescribing of DOACs.<sup>50,101</sup> However, the incidence of OAC prescribing still remains lower for the elderly than for younger patients due to a risk of falls, dementia, and/or previous bleeds.<sup>102,103</sup> This is despite studies showing that many patients individually value the benefit of stroke prevention over any inherent bleeding risk.<sup>104,105</sup> Furthermore, suboptimal DOAC dosing remains a significant problem in the elderly population, with one large study identifying almost a quarter of patients being either overdosed (15%) or underdosed (5%).<sup>106</sup> Persistence to DOACs in the long term (>1 year) is found to be higher than for VKAs in a number of studies.<sup>39,50,107</sup> One of the main reasons for non-persistence with DOACs, is cost, followed closely by patient preference, stopping their medication due to a fear of bleeding and/or the absence of any AF-associated symptoms,<sup>50</sup> which can lead to medication being considered as “optional” both by patient and physician. A notable example where “optional medication” is commonplace is in hypertension, where adherence rates can range from 9–37%<sup>40</sup> and poor blood pressure control as a consequence is estimated to cause 10 million deaths, each year.<sup>41</sup> Similarly, once a patient LTC is under control, they may also feel they require no further need for any medication.

## Non-Adherence to DOACs

Surprisingly, despite improved persistence and the many advantages that DOACs bestow over traditional VKAs, under prescribing and poor adherence, still remains an ongoing global challenge. Non-adherence to all DOACs has been reported to occur in up to 40% of AF patients in particular, among the elderly.<sup>34,92,108</sup> One large systematic review highlighted that patients were missing on average one dose in four of their DOACs.<sup>107</sup> The actual “real-world” level of non-adherence is likely to be much higher, with almost 50% of non-adherent patients in one study, reported not to disclose non-adherence behaviour to their HCPs.<sup>34</sup> Compared to VKAs, DOACs have much shorter half-lives, ~12 hours, compared to ~40 hours for VKAs, such that low adherence significantly reduces their efficacy and subsequently, therapeutic benefit to the patient, making DOAC adherence essential.<sup>109</sup> There is clear evidence demonstrating a significant risk of stroke and all-cause mortality in patients with AF, when DOAC medication is not adhered to.<sup>110,111</sup>

Ironically, a lack of INR monitoring for DOACs, and thus the subsequent loss of regular contact with a medical professional has been shown to impact adherence negatively, opposite to what was predicted would happen.<sup>34</sup> Other reasons for non-adherence include forgetfulness, having no symptoms, fear of bleeding and not having a reversal agent, and cost of medication for those patients having to pay, all result in occasional doses being missed.<sup>34,50</sup> Predictors of greater adherence include older age, increasing co-morbidities, previous history of stroke, hypertension, diabetes, patient knowledge and education, and physician contact (see Figure 4).<sup>34,93,111,112</sup> Unsurprisingly, reasons for patient non-adherence to OACs, as for most medications for LTCs are multi-factorial, patient specific, and thus not easily resolved with a “one-size-fits-all” approach. It is clear from the evidence, however, that finding practical solutions that ensure that OACS are properly adhered to



**Figure 4** Factors promoting adherence to OAC therapy in AF patients. Figure created with BioRender.com.

**Notes:** Adapted from Proietti M, Lane DA. The compelling issue of nonvitamin K antagonist oral anticoagulant adherence in atrial fibrillation patients: A systematic need for new strategies. *Thromb Haemost.* 2020;120(3):369–371. © Georg Thieme Verlag KG.<sup>139</sup>

**Abbreviations:** AF, atrial fibrillation; OAC, oral anticoagulant; INR, international normalised ratio; MUR, medication use review.

and optimally used to their full therapeutic benefit, but also identify at-risk patients that are either non-persistent or -adherent, is required. The complexities of adherence to life-long medications, however, have resulted in equally complicated, time and resource consuming interventions that are more often than not, ineffective.<sup>46</sup>

## Role of the Pharmacist in OAC Adherence

Allied HCPs, such as pharmacists, are uniquely positioned to fill this important role in identifying patients who are non-adherent/persistent to their OAC medication, counselling patients on the value of taking their medication, offering written and verbal advice, understanding individual patient needs and burdens, and optimizing patient adherence, safety, and treatment outcomes.<sup>113</sup> Physicians report time pressures as a barrier for not tackling adherence issues,<sup>114</sup> and subsequently are enlisting pharmacists to act as an intermediary in educating and counselling patients.<sup>115,116</sup> In some countries, such as the US, it is already a legal requirement for pharmacists to counsel patients on their medicines.<sup>117</sup> Thus, an expansion of the pharmacist role to promote and support adherence, particularly as pharmacists see patients far more frequently than all other primary care,<sup>118,119</sup> could be feasible and time/cost effective. Indeed, this role for the pharmacist has already been identified<sup>120</sup> for the delivery of the Atrial Fibrillation Better Care (ABC: Avoid stroke Better symptom management Cardiovascular and other comorbidities) pathway.<sup>121</sup> This framework designed for an individualised, integrated approach to AF management across care settings is recommended in the guidelines of the European Society of Cardiology and Asia Pacific Heart Rhythm Society.<sup>71,122</sup> Similarly in the UK, as part of the Community Pharmacy Contractual Framework,<sup>123</sup> community pharmacists deliver medicine use reviews (MUR) and the new medicine service (NMS), interventions designed to improve understanding and adherence to medicines in LTC<sup>124,125</sup> and comparable services exist globally.<sup>126</sup> Whilst in some countries, both hospital and community-based pharmacist are involved in the delivery of anticoagulation management services (AMS) for patients on VKAs, in order to improve INR control and to provide a convenient, local service for patients.<sup>127–130</sup> This was extended in 2013, in the US to include DOACs, where a patient can be referred to an AMS service for assessment and ongoing monitoring of their DOAC by a pharmacist.

There have been a number of studies over the past 10-years assessing pharmacist-led interventions for AF screening and OAC management across secondary and primary care (see comprehensive review by Ritchie et al, 2022), which have shown that pharmacist-led interventions can improve adherence to OACs.<sup>120</sup> In the next section, I will aim to review some of the most recent studies that have taken place in primary and community care that focus on OAC management and improving adherence.

## Pharmacist-Led OAC Management Interventions Intervention I

Pharmacist delivering medication optimisation reviews of patients OAC therapy is one way of improving health outcomes for patients with AF. In a recent, retrospective observational study, independent prescribing pharmacists based in GP practices in Bradford delivered a medication optimisation intervention to 616 patients with a confirmed nonvalvular AF diagnosis and on the Quality and Outcomes Framework (QOF) AF register.<sup>131</sup> From the medical records, 76% (470/616) were on established OAC treatment pre-intervention, with 37% of these on VKA therapy (172/470), 98% (168/172) of those on warfarin. Post pharmacist intervention, of those patients not previously on any stroke preventative medication but deemed eligible, 25% (37/146) were successfully initiated on DOACs. Of the patients that were on VKA therapy pre-intervention (172/616), 20% (35/172) of them were determined by the pharmacist as eligible to transfer to DOAC therapy, of which 25% (9/35) were successfully converted. The main reasons for non-conversion were patient preference (69%) and cost (19%). Whilst inappropriate dosing of DOACs, both over- and under-dosing, was identified in 24% (73/298) of patients, pre-intervention and was re-optimised in line with recommended guidance and considering individual patient parameters, for 94% (68/73) of them. The most common inappropriately prescribed DOAC was rivaroxaban. Finally, an assessment of patients bleed risk resulted in 73% of the patients having a reduction in their HAS-BLED score by at least one point ( $3.00 \pm 0.65$  vs  $2.22 \pm 0.79$ ). Overall, the study demonstrated that pharmacists based in UK GP practices and accessing patient records could optimise the safe and effective use of OAC therapy for established AF patients, highlighting the importance of targeted medication optimisation reviews for LTCs such as AF.

## Intervention 2

Another example of pharmacist-led management of OACs is through the anticoagulation management service (AMS). Originally set up to monitor the INR of patients on VKAs in an outpatient setting by pharmacists, it was extended to include DOACs assessment and monitoring in 2013, in the US. The service was available to any medical provider to refer a patient for assessment. This involved the pharmacist having access to a patients' medical record, to determine drug selection, dosing, and to access any laboratory test results (eg serum creatinine for renal functioning) or to request tests. They would then contact the patient by telephone to discuss their medication, determine any issues, including affordability, and to educate the patient about the medication and importance of adhering to it. The pharmacist would then make recommendations to the medical care provider for any changes (drug type, dosing, etc.) that needed to be made if required. The pharmacist would follow-up with the patients two weeks later to see how the patient was getting on with the medication and to determine adherence and again 3–6 months later, but this time including a renal function assessment. Patient contact would be ongoing (every 3–6 months) for the duration of their treatment. A retrospective observational study in the US, compared 129 patients that had been through the pharmacist-led DOAC service for one year (2013–2014) and compared them with 129 patients that had received normal care for their DOAC, from the physician, to determine appropriateness of therapy and adherence.<sup>132</sup> More than half of the participants were indicated for AF in each cohort. The study found that patients that had been seen through the pharmacist-led DOAC service were significantly more likely to be initiated and continued on the appropriate DOAC and at the correct dose for their condition, than the usual care group (93% vs 79.1% - baseline, 93.7% vs 81.1% - 3–6 months). In addition, patients in the pharmacist-led DOAC service, who received ongoing education and support were significantly more likely to be adherent than the standard care group (91.8% vs 79.3%). As was seen for the previous study, this intervention demonstrated that pharmacists were able to ensure patients were on the correct DOAC and dose for their particular indication, but additionally it showed that continued follow-up with patients, facilitated improved patient adherence to their medication and assisted in overcoming barriers, such as medication affordability.

## Intervention 3

Similarly, a community pharmacist-led intervention using the UK New Medicines Service (NMS) framework was piloted in Poland to see if adherence to dabigatran, previously reported as being suboptimal in 50% of AF patients<sup>133</sup> was improved.<sup>134</sup> The study demonstrated that using a combination of in-person, involving face-to-face (medication reconciliation, patient education, side-effect management); telephone calls (motivational interviewing around adherence challenges and barriers to adherence) and indirect involving pictogram-enhanced information leaflet and medication labels, smartphone daily medication reminders, correlated with better adherence to dabigatran than a control group receiving regular dispensing care. Over 3 months, the study found that patients receiving the intervention were significantly more adherent to their prescribed dose (twice/day) at each time point, than the control group receiving standard care (82.7% vs 71.4% - day 7; 84.4% vs 58% - day 21; 78.4% vs 39.7% - day 90). Furthermore, the proportion of patients fully adherent at the end of the study (90 days) was significantly higher than the control group (26.1% vs 13.2%) demonstrating that interventions that educate and counsel at the start of a patients' medication journey and then provide ongoing support, improves patient adherence to their drug therapy and mitigates the habitual decline in adherence over time, observed for many chronic conditions.

## Intervention 4

Despite the introduction and popularity of DOACs, warfarin is still the most commonly prescribed oral anticoagulant and widely used by patients with AF. The narrow therapeutic index of warfarin, a range which is indication-dependent and the side effects that can occur when a patient is not on the correct INR, such as a risk of bleeding when over-dosed or risk of stroke when under-dosed means for a patient to achieve maximal therapeutic benefit, they must maintain an optimal therapeutic range (TTR), involving regular monitoring. In recent years, this monitoring service has moved out into the community, where it is more accessible and is frequently run by nurses and pharmacists.<sup>128–130</sup> A number of retrospective studies have shown a significant positive correlation between pharmacist-led, warfarin management services and stable



TTR, INR parameters and fewer adverse events, compared to those receiving normal care (Aidit et al, 2017, Lee et al, 2016, Phelps et al, 2018).<sup>135–137</sup> In a combined retrospective and prospective study based in Brazil, 268 patients with AF diagnosis, who had been receiving warfarin therapy managed by a physician for a least one year and had a TTR < 50% (retrospective) were transferred to a prospective intervention.<sup>138</sup> The prospective arm of the study involved 12 weeks under the care of a clinical pharmacist and involved in-person one-to-one consultations, which involved at baseline, medication reconciliation, patient education, side-effect management, possible drug and food interactions, motivational interviewing on the benefits of adherence, INR measurements and made any necessary dose adjustments to achieve target therapeutic range (INR 2.0–3.0). This was followed by four further pharmacist consultations, occurring every 7 days, where INR was tested, warfarin dose adjustments made, and adherence evaluated. After the fourth visit, if the INR was stable, the patient's next appointment was for 30 days' time or 7 days if unstable, until 12 weeks of follow-up were completed. Calculation of the mean TTR pre-intervention after >1 year of physician management, and following 12 weeks of pharmacist post-intervention, showed a significant improvement in TTR values from 14.4% to 54.3%. Despite the fact that the TTR achieved is still lower than the recommended optimal TTR level of >70%, possibly due to the short intervention time with very poorly controlled patients, this study showed that pharmacist-led warfarin management significantly improved the therapeutic range of these patients and reduced the risk of adverse events.

## Conclusion

Prescribing of OACs for patients diagnosed with AF will be for the vast majority a life-long commitment. This review has shown that ensuring adherence and persistence with these therapies, for which the benefit of such may not always be perceived by the patient and sometimes the physician, should be at the forefront of clinical practice and interventions. Stroke, along with other noncommunicable diseases such as diabetes, chronic obstructive pulmonary disease, and cancer are responsible for 74% of all deaths globally.<sup>8</sup> Non-adherence to life-preserving medications for LTCs is recognised as a global public health issue and is impacting negatively the ability of health services around the globe to achieve population health goals.<sup>10</sup> Proper prescribing of medicines and then fully adhering to these medications for LTCs, is considered by policy makers as the most propitious, in terms of positive outcomes for patients and equally overstretched healthcare systems.<sup>10</sup> Interventions such as the one's showcased here, that improve adherence to life-preserving medication such as OACs and target individuals most at risk of non-adherence, such as the elderly, are essential. A pharmacist will see patients of LTCs far more often than any other HCP, due in part to the introduction of the repeat dispensing scheme, which allows patients to receive up to 12 months' supply of their medicines from the community pharmacist.<sup>140</sup> Furthermore, a community pharmacist is often more readily accessible on a day to day basis, than a physician, with a patient twice as likely to visit a pharmacist than a physician.<sup>118</sup> In addition, compared to a physician, pharmacists are able to spend more time promoting medication adherence, and counselling the patient on the importance of OAC therapy and the possibility of adverse events. This opportune contact when dispensing medicines, plus a pharmacists' vast experience of medicines and of delivering reviews of medicines, are activities which the public most closely associate with the role of a pharmacist and trust them to do, compared with some of the more clinical roles now being undertaken.<sup>126,141</sup> Despite this rather obvious pathway for medicines management for community pharmacists, however, gaining access to a patient's clinical records, including having a good working relationship with local physicians and the time available outside of routine dispensing workflows, can limit the success or reach of some interventions, and more research will be needed to address this.<sup>142</sup> However, more adherent patients, means more prescriptions dispensed from the pharmacy, which results in increased revenue both from the filled prescriptions and from paid initiatives to improve adherence.<sup>143</sup> Here, I have shown some tested examples of pharmacist-led OAC management initiatives that have demonstrated feasibility and improved health outcomes for patients with AF. Combining OAC management together with a pharmacist-led AF screening intervention, for which there have been many reported successes,<sup>120</sup> promises wide-reaching benefits to the healthcare system in the future.

## Acknowledgments

I would like to thank Alistair Mathie for his helpful comments on the manuscript.

## Disclosure

The author reports no conflicts of interest in this work.

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