



**Joint Strategic Needs Assessment
supporting strategic planning
for
Health and Social Care Partnerships**

**Rapid assessment:
Reducing avoidable emergency admissions**

Contents

Key recommendations for decision makers.....	3
Executive Summary	4
1 Introduction.....	6
2 Conceptual framework – description of the pathway to emergency admission....	7
3 Methodology	8
3.1 Analysis of emergency admission data	8
3.2 Literature review.....	8
4 Analysis of emergency hospital admission data	9
4.1 Ambulatory Care Sensitive Conditions.....	11
4.2 Preventable neoplasms.....	17
4.3 Injuries	19
4.3.1 Falls.....	21
5 Evidence for Models of Care to prevent avoidable hospital admissions	22
5.1 Caveats for Decision Makers	23
6 Summary review of literature: reducing emergency admissions in the top five ambulatory care sensitive conditions.....	28
6.1 Angina.....	28
6.2 UTI and Pyelonephritis.....	28
6.3 COPD.....	28
6.4 Dehydration or gastroenteritis	28
6.5 Pneumonia.....	28
6.6 Influenza	29
7 Conclusion.....	29
References.....	30

Acknowledgements

We would to thank Seb Ayers, John O’Dowd, David Rae, Catriona Sked and Debby Wason for their invaluable input to this report. Thanks to Library Services for conducting the literature searches.

Key recommendations for decision makers

36% of all emergency admissions in Ayrshire and Arran are potentially avoidable by timely and appropriate intervention in primary, community and social care. We would recommend that Health and Social Care Partnerships and NHS Ayrshire and Arran use our findings to inform how resources and funding is allocated, in providing evidence-informed models of care aimed at reducing avoidable admissions:

1) We recommend ensuring adequate funding and resource is in place for the following interventions aimed at reducing avoidable hospital admissions:

- Interventions at A&E: review by senior clinician and GP-led assessment units for urgent referrals from community GPs.
- Integrated Clinical Care programmes for heart failure, COPD, Asthma and Diabetes.
- Exercise-based rehabilitation for CHD.
- Case management for Heart Failure.
- Home visits (plus telephone support) for heart failure patients; pregnant women with hypertension and/or diabetes, and in mental health patients.
- Self-management, including practitioner review, in asthma and COPD patients
- Specialist clinics for heart failure patients.
- Assertive Community Treatment for mental health patients.
- Managed Clinical Networks (MCN) in patients with angina and diabetes.
- Tele-related health care in older people and in people with heart failure, CHD, hypertension and diabetes.

2) For reducing avoidable admissions for COPD exacerbations, we recommend ensuring adequate resource and funding is in place for:

- Smoking cessation to be offered to all patients with COPD.
- The step-wise approach to drug therapy as outlined in the NICE Guideline for COPD.
- Pulmonary rehabilitation for all patients with moderate to severe COPD.
- Influenza vaccination for patients with COPD.

3) Planners need to consider how to address the finding that the following interventions increase avoidable admissions:

- Hospital at Home for a range of patient types that would otherwise require in-patient care.
- Integrated Care Packages that comprise horizontal integration between health and social care.

It is important to remember that a whole host of other factors will affect emergency admission trends including demographics, socio-cultural norms and social care. Decreases in social care budgets and ability to provide social care will have an adverse impact on emergency admission rates, as will increased population deprivation.

Executive Summary

Over the past thirty years the steady rise in the number of emergency inpatient admissions to hospital has been a major source of pressure for the NHS. The reasons for this increase are complex and include an ageing population and changing social factors increasing the demand for formal care. There is growing evidence that a significant proportion of patients treated in A&E are not there because it is the best place for them to be treated, but because they have ended up there by default. Understanding what drives emergency admissions is complex.

This report was requested by a group with representatives from the three Ayrshire Health and Social Care Partnerships (HSCPs), charged with scoping a rapid needs assessment to inform HSCP strategic planning. Partners agreed that an understanding of emergency admissions was a top priority for the partnerships.

It is important to understand what proportion of all emergency admissions could have been treated more appropriately elsewhere, and what that care could look like. Analysis of emergency admission data, combined with review of the available evidence base, can help to focus or target interventions aimed at providing evidence informed integrated care. This report highlights the key findings of an analysis of emergency admission data for Ayrshire and Arran using 2013/14 data, primarily to inform HSCP strategic planning. The intention of this report is primarily to provide planners within Health and Social Care Partnerships with an enhanced understanding of what proportion of all emergency admissions could have been treated more appropriately elsewhere, and what that care could look like.

A total of 48,378 continuous inpatient stays were recorded as beginning and ending during 2013/14. This equates to 33,025 patients or 284,001 bed days.

Emergency admissions from care homes have been identified anecdotally as a significant source of avoidable admissions locally. During 2013/14, 1,359 presentations from care homes to A&E were admitted to hospital. This figure accounts for only 3% of emergency admissions during 2013/14.

Ambulatory Care Sensitive Conditions (ACSCs) accounted for 36% of all emergency admissions. These are conditions for which admissions could be prevented by appropriate and timely intervention in primary, community and social care. The top categories of ACSC were angina (9% of all emergency admissions), UTI/pyelonephritis (4%), COPD (3%), dehydration/gastroenteritis (3%) and influenza/pneumonia (2%). The number of bed days accounted for by avoidable admissions in 2013/14 ranged from 8,163 for angina to 17,212 for UTI/pyelonephritis. Avoidable admissions were most prevalent within areas of greater deprivation, with this effect particularly noticeable among working age adults.

The importance of prevention in reducing emergency admissions cannot be understated. 3% of all emergency admissions are due to preventable neoplasms, and 16% are due to injury. There is a preventable component to each of the top five

ambulatory care sensitive conditions. Although upstream prevention was not within the scope of this report, its importance should not be forgotten.

A literature review of systematic reviews was undertaken, exploring models of care which show potential for reducing avoidable emergency admissions. The evidence around reducing avoidable emergency admissions is mixed, and highlights the importance of robust evaluation of any new models of care or interventions. Models of care that can help to reduce avoidable admissions include:

- Interventions at A&E: review by senior clinician and GP-led assessment units for urgent referrals from community GPs.
- Exercise-based rehabilitation for CHD and COPD
- Integrated Clinical Care programmes for heart failure, COPD, Asthma and Diabetes
- Case management for Heart Failure
- Home visits (plus telephone support) for heart failure patients, pregnant women with hypertension and/or diabetes, and in mental health patients
- Self-management, including practitioner review, in asthma and COPD patients
- Specialist clinics for heart failure patients
- Assertive Community Treatment for mental health patients
- Managed Clinical Networks (MCNs) in patients with angina and diabetes
- Tele-related health care in older people and in people with heart failure, CHD, hypertension and diabetes

It is important to point out that because most avoidable admissions are due to a range of factors, no single model or intervention will be effective in reducing admission rates and a whole-systems approach will be required.

A second literature review looked at the current evidence base for interventions with the potential to reduce avoidable admissions for the top five ambulatory care sensitive conditions in Ayrshire and Arran. The most well researched area with the most robust evidence is for prevention of admissions due to COPD exacerbations. For the other four conditions we have provided some insight into interventions which show promise in terms of their ability to reduce avoidable admissions. For COPD the most effective intervention is smoking cessation. Pulmonary rehab is also very effective in reducing hospital admissions and mortality.

The findings of this report have implications for service planning. Our main recommendation is that Health and Social Care Partnership planners and decision makers read this report and use the findings to ensure strategic planning is intelligence informed.

1 Introduction

Over the past thirty years the steady rise in the number of emergency inpatient admissions to hospital has been a major source of pressure for the NHS. The reasons for this increase are complex and include an ageing population and changing social factors increasing the demand for formal care. Interestingly, analysis has shown that the elderly population is not becoming more unwell, which is often used to explain rising rates of emergency admission. The decline in long-stay NHS beds and the squeeze on residential care places is likely to have increased the number of frail older people living in the community. This may have been compounded by a decreasing capacity of families to provide informal care. All of these factors may have increased the demand for formal care directed at primary and social care sectors. When the needs of individuals exceed the capacity for delivery within primary care, it results in increased emergency inpatient admission. This is particularly true of patients with chronic and often multiple conditions.

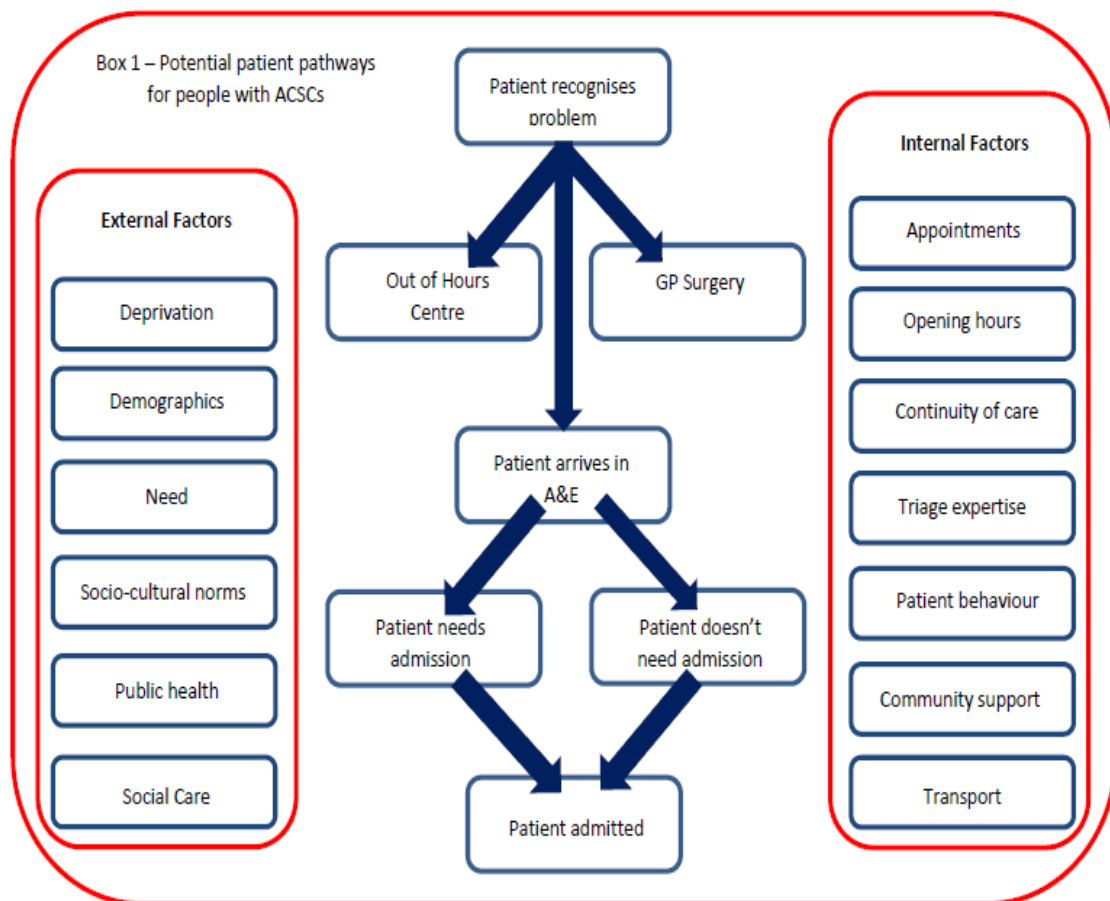
There is growing evidence that a significant proportion of patients treated in A&E are not there because it is the best place for them to be treated, but because they have ended up there by default. Understanding what drives emergency admissions is complex. A proportion of emergency admissions will be completely appropriate. It is important that we begin to understand what proportion of all emergency admissions could have been treated more appropriately elsewhere, and what that care could look like. This is the main focus of this report.

Analysis of emergency admission data, combined with review of the available evidence base, can help to focus or target interventions aimed at providing evidence informed integrated care. Work is ongoing both nationally and locally to improve the management of acute hospital admissions. This report highlights the key findings of an analysis of emergency admission data for NHS Ayrshire and Arran using 2013/14 data, to inform Health and Social Care Partnership (HSCP) strategic planning. A needs assessment planning group met several times, with representatives from each of the three Ayrshire HSCPs. The group recommended emergency admissions as one of the priority areas to be addressed by this piece of work. As a result of this request the Public Health Department conducted a detailed analysis of avoidable emergency admissions, something that has not been analysed in-depth locally.

The intention of this report is primarily to provide planners within HSCPs with an enhanced understanding of what proportion of all emergency admissions could have been treated more appropriately elsewhere, and what that care could look like. The findings section will present the findings of the analysis of emergency admissions, followed by a summary of the current evidence base around preventing avoidable admissions, and models of care that are more appropriate for ambulatory care sensitive conditions. By definition, these conditions are ones for which admissions could be prevented by interventions in primary, community or social care.

2 Conceptual framework – description of the pathway to emergency admission

The following illustration provides a useful framework for understanding all of the interacting factors that influence emergency admissions for ambulatory care sensitive conditions. This report focuses on models of care that can impact on avoidable emergency admissions. However it is important to remember that a whole host of other factors will affect emergency admission trends including demographics, socio cultural norms and social care. Decreases in social care budgets and ability to provide social care will have an adverse impact on emergency admission rates, as will increased population deprivation. Internal factors affecting emergency admissions include ease of access to primary care appointments and patient behaviour.



Source: NHS England (2014) Emergency Admission Technical Paper: Understanding drivers of emergency admissions for ambulatory care-sensitive conditions

3 Methodology

3.1 Analysis of emergency admission data

SMR01 data were extracted from ISD Scotland's ACaDMe data warehouse for continuous inpatient stays (CIS) beginning and ending during 2013/14 financial year for NHS Ayrshire & Arran residents coded as an emergency admission.

The primary analysis of avoidable emergency admissions to hospital focused on Ambulatory Care Sensitive Conditions (ACSC) as identified by Purdy *et al* (2009) based on ACSC coding used in NHS England and a review of international literature on ACSCs. This definition incorporates 36 categories of conditions¹ for which admission could be avoided by interventions in primary, community or social care,. ACSC coding was based on the ICD-10 code in the primary diagnosis position.

In addition, analyses were undertaken on preventable neoplasms, as defined by the Office of National Statistics' preventable causes of mortality (Office of National Statistics 2012), among patients aged under 75 years in any diagnosis position. Analyses were also undertaken of intentional and unintentional injury codes within ICD-10 which permit the classification of environmental events and circumstances as the cause of injury, poisoning and other adverse effects. These are designed to provide supplementary information to a primary diagnosis and as such are coded within diagnosis positions 2-6.

Rates are calculated either as age standardised to the European standard population or as age specific rates for five year age bands. This measure allows comparison between groups and/or over time whilst discounting any difference in the age structure of the populations being compared. These rates are different to crude rates. Confidence intervals for age standardised rates are presented at the 95% confidence level. As a general rule of thumb we can assume a significant difference between groups where intervals do not overlap. In cases where intervals do overlap we cannot assume a significant difference.

3.2 Literature review

A literature search was undertaken including the terms avoidable / unscheduled /unplanned hospital admissions, returning 118 articles. Abstracts were scanned for review articles which were included in a 'review of reviews'. In addition, PubMed, NIHR, the Cochrane Database and the Health Technology Assessment Database were hand-searched for systematic reviews relevant to interventions for avoidable admissions.

¹ 35 categories have been used in this analysis. Purdy *et al* used a non-ICD10 code for identifying self harm which does not appear to be used locally. Instead self harm is incorporate within the analysis of injury coding. (List of conditions available on request.)

4 Analysis of emergency hospital admission data

Table 1 provides a summary of the SMR01 data extracted from ACaDMe. A total of 48,378 continuous inpatient stays (CIS) were recorded as beginning and ending during 2013/14. This equates to 33,025 patients or 284,001 bed days. The age standardised rate of emergency admissions was higher than the Ayrshire & Arran rate of 10,972 per 100,000 population in North Ayrshire (11,373) and lower in South Ayrshire (10,184). The rate for East Ayrshire (11,243) did not appear to be significantly different to the Ayrshire & Arran rate.

Ambulatory care sensitive conditions (ACSCs) accounted for 36% of all emergency admissions during the same time period. These are conditions for which admission could potentially be avoided by interventions in primary, community or social care. 13,767 patients and 107,511 bed days were associated with ACSC stays during 2013/14. Preventable neoplasms accounted for 3% of all emergency admissions, involving 1,101 patients and 9,853 bed days during 2013/14. Injuries accounted for 16% of all emergency admissions, involving 6,654 patients and 50,327 bed days during 2013/14. It should be noted that these classifications are not mutually exclusive and therefore percentages are not cumulative.

Table 1: Summary of emergency admissions involving Ayrshire & Arran residents during 2013/14

	All emergency admissions	Emergency admissions - ACSC	Emergency admissions - preventable neoplasms	Emergency admissions - injuries
Number of admissions	48,378	17,621	1,148	7,559
% of emergency admissions	100%	36%	3%	16%
Number of patients	33,025	13,767	1,101	6,654
Number of bed days	284,001	107,511	9,853	50,327

Sixty per cent of admissions were treated at University Hospital Crosshouse and 32% at University Hospital Ayr. This could be due to differing 'catchments', capacity and specialty provision. The remaining emergency admissions were either treated in another NHS Ayrshire & Arran hospital (2%) or another NHS Board area (6%).

A separate analysis of the A&E dataset recorded 117,663 presentations during 2013/14 by Ayrshire and Arran residents with 45,295 admissions, giving a conversion rate of 39%. This is lower than the number of admissions recorded in the SMR01 extract, presumably as SMR01 will also include emergency admissions that did not go through A&E. The A&E figures give an indication of the burden of emergency presentations that are not admitted.

Emergency admissions from care homes have been identified anecdotally as a significant source of avoidable admissions locally. The SMR01 data had 557

emergency admissions recorded as coming from care homes during 2013/14. However, it is likely that admissions from care homes have been under-recorded. A separate analysis of A&E data undertaken by NHS Ayrshire & Arran's Business Intelligence Team, which used patients' address of residence to recode presentations from care homes, found that 1,359 presentations from care homes to A&E were admitted to hospital during 2013/14. This higher estimate would account for only 3% of emergency admissions during 2013/14.

4.1 Ambulatory Care Sensitive Conditions

Key messages

36% of emergency admissions were for Ambulatory Care Sensitive Conditions (ACSCs) - conditions for which admissions could be prevented by intervention in primary, community or social care.

The top five categories of ACSC were Angina (9% of emergency admissions), urinary tract infection/pyelonephritis (4%), chronic obstructive pulmonary disease (3%), dehydration/gastroenteritis (3%) and influenza/pneumonia (2%).

Lower age standardised rates were observed in South Ayrshire for three of the top five ACSC categories, with the exception of dehydration/gastroenteritis and UTI/pyelonephritis. This appears to be related to the lower overall rate of emergency admissions in South Ayrshire as the percentage of admissions classed as ACSC was similar in each HSCP area.

ACSCs were most prevalent among older people but were also common among children aged 0-4 years.

ACSCs were more prevalent within areas of greater deprivation across the life course, with the disparity between most and least deprived areas greatest among working age adults.

The overall age standardised rate of ACSC-related admissions for Ayrshire and Arran during 2013/14 was 3,866 per 100,000 population. South Ayrshire appears to have a lower age standardised rate than the Ayrshire and Arran average, while East and North do not appear to be significantly different from the Ayrshire and Arran average. This appears to be related to the lower overall rate of emergency admissions in South Ayrshire as the percentage of admissions classed as ACSC was similar in each HSCP area.

No obvious difference in rate of ACSC-related admission was observed between males and females (Figure 1). However, the proportion of admissions classed as ACSC was higher for females (38%) than for males (35%).

ACSC-related admission rates are relatively high among children aged 0-4 years before dropping sharply and remaining low during the rest of childhood (Figure 2). Rates increase slowly but steadily during adult working-age years (20-64 years) before rising sharply during older age (65 years and older).

The proportion of admissions classed as ACSC among working age adults was the same as the overall proportion (36%), while the proportion among children was significantly lower (31%) and the proportion among older people was significantly higher (39%).

Figure 1: European age standardised rates per 100,000 population of continuous inpatient stays resulting from an emergency admission with primary diagnosis classed as ACSC 2013/14; by sex and HSCP area

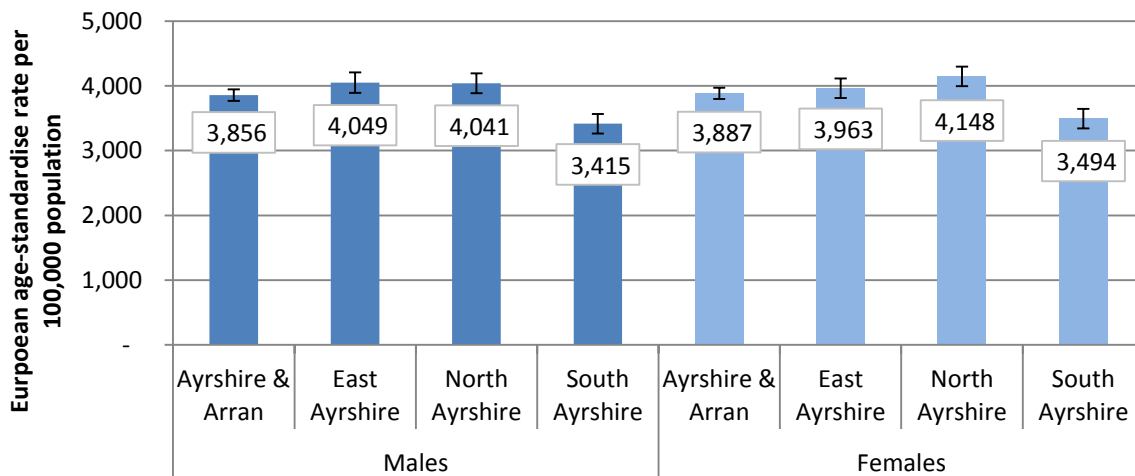


Figure 2: Age specific rates per 100,000 population of continuous inpatient stays resulting from an emergency admission with primary diagnosis classed as ACSC 2013/14; by HSCP area

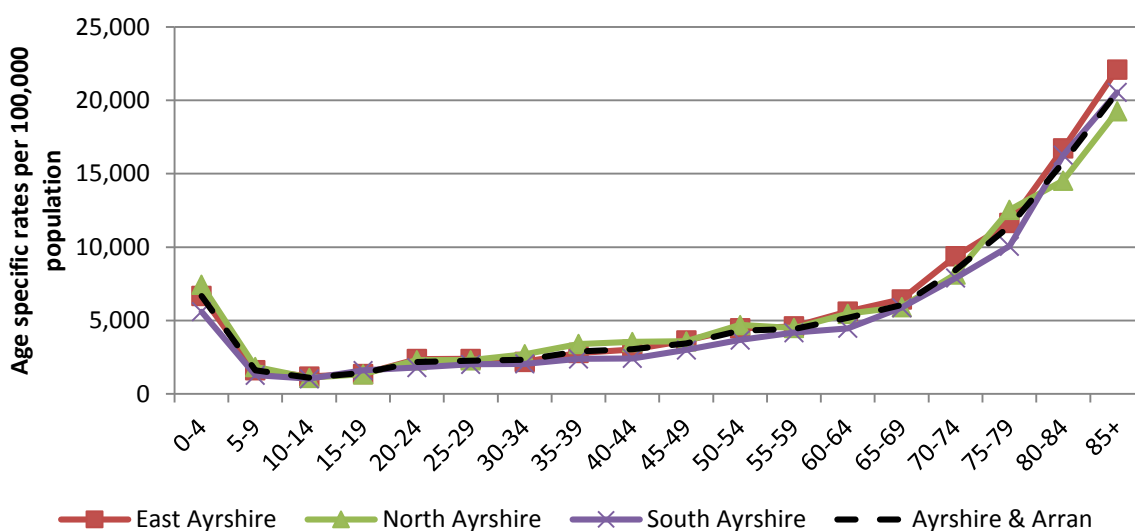


Figure 3 shows the age standardised rates for ACSC-related admissions by Scottish Index of Deprivation (SIMD) quintile. There is a clear deprivation gradient, with the rate of ACSC-related admissions in the most deprived quintile being over twice the rate within the least deprived quintile². The deprivation gradient does not appear to remain static across the life course (Figure 4). The ratio of ACSC-related admission rates between the most and least deprived quintiles is greatest among working age

² Emergency stays in hospital are one of the indicators within the Health domain of SIMD. For SIMD 2012 this covers the time period 2007-10 and accounts for 0.47 of the overall Health domain weighting.

adults and lower among children and older people. This may reflect the accumulation of material disadvantage into adulthood and higher premature mortality rates associated with deprivation. In addition, the ratio between most and least deprived quintiles is higher for ACSC-related admissions across the life course than for emergency admissions as a whole. The proportion of admissions classed as ACSC within quintile 1 (37%) was found to be significantly higher than the proportion within quintile 5 (34%). One explanation for this could be an inverse care law in operation in primary care. In other words, those who most need good health care are least likely to have access to it.

Figure 3: European age standardised rates per 100,000 population of continuous inpatient stays resulting from an emergency admission with primary diagnosis classed as ACSC during 2013/14; by SIMD 2012 quintile

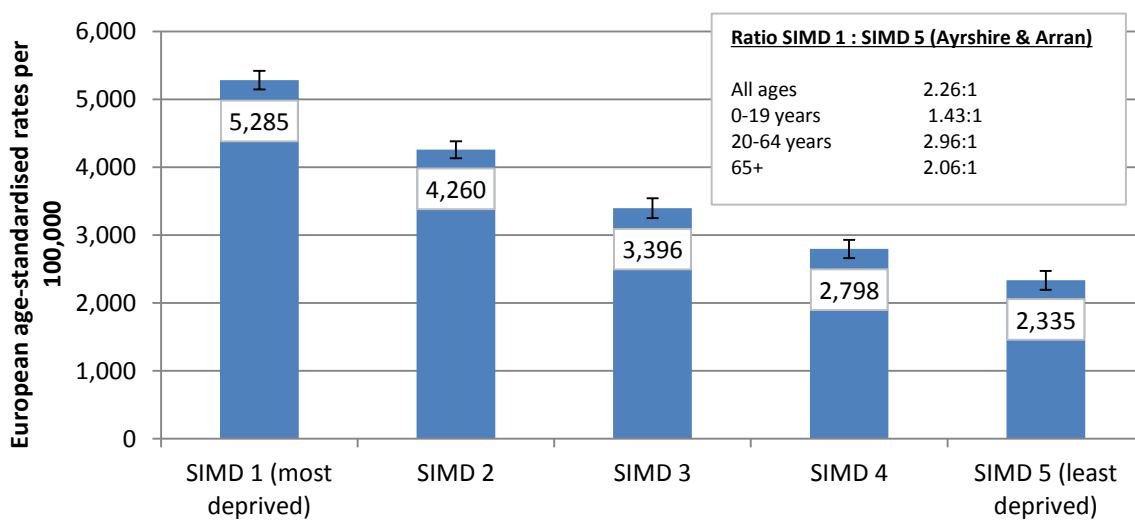
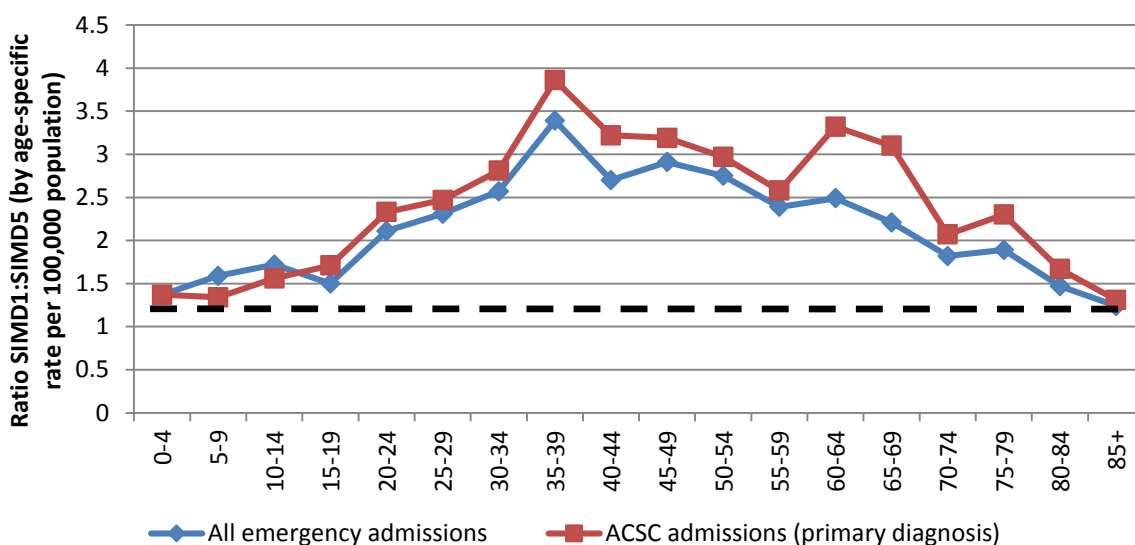


Figure 4: Ratio (SIMD1:SIMD5) of ACSC-related admissions within Ayrshire and Arran during 2013/14 for age specific rate per 100,000 population



The top five ACSC categories were identified for specific analysis within this report (Table 2). Angina was the most common ACSC category, accounting for 9% of emergency admissions during 2013/14. This was followed by urinary tract infection (UTI) or pyelonephritis (4%), chronic obstructive pulmonary disease (COPD) (3%), dehydration or gastroenteritis (3%) and influenza or pneumonia (2%). The same categories were also the top five for older people. Angina, UTI/pyelonephritis and COPD were joined in the top five for working adults by migraine/acute headache and cellulitis. Ear, nose and throat infections were the most common ACSC category for children and young people, followed by dehydration or gastroenteritis, asthma, UTI/pyelonephritis and constipation.

In each of the top five categories, the majority of patients had only one admission during 2013/14 where that specific ACSC category was the primary diagnosis (Table 2). COPD was the category with the highest proportion of subsequent admissions (48%), while dehydration/gastroenteritis was the category with the lowest proportion of subsequent admissions (29%).

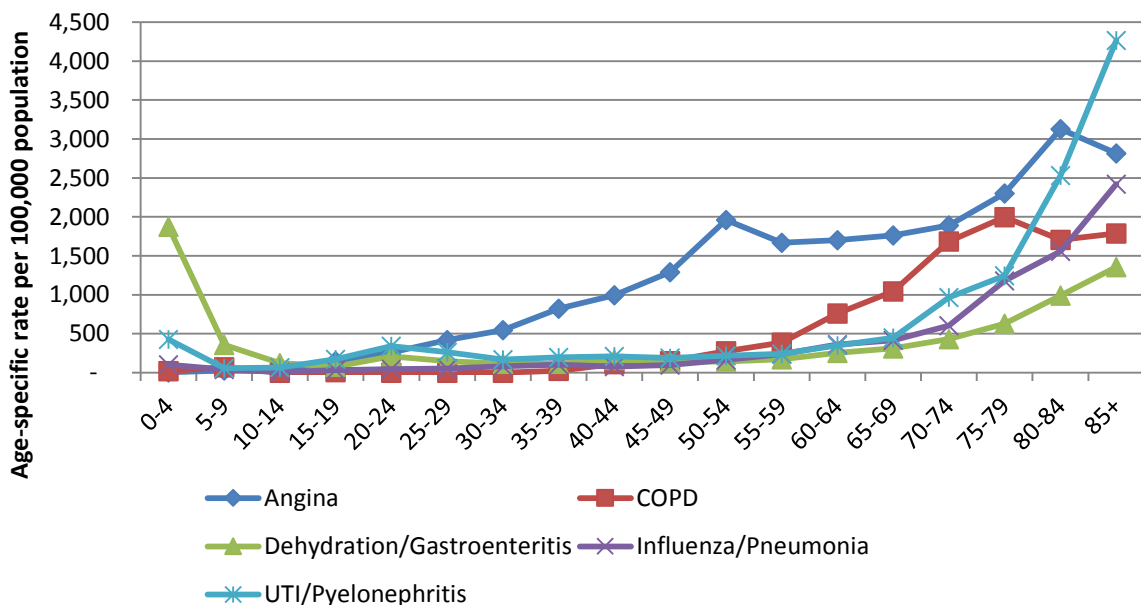
Although angina was the ACSC category with the highest number of admissions and patients, UTI/Pyelonephritis was the category with the highest number of associated bed days. Two other ACSC categories outwith the top five were associated with high numbers of bed days: stroke (13,683 bed days) and fractured proximal femur (11,645 bed days).

Table 2: Summary of top five categories of ACSC-related emergency admissions involving Ayrshire & Arran residents during 2013/14

	Angina	COPD	Dehydration/ gastroenteritis	Influenza/ pneumonia	UTI/ pyelonephritis
Number of admissions	4,174	1,652	1,295	1,092	1,759
% of emergency admissions	9%	3%	3%	2%	4%
% ACSC admissions	24%	9%	7%	6%	10%
Number of patients	2,910	853	923	697	1,127
% of stays that are subsequent admissions	30%	48%	29%	36%	36%
Number of bed days	8,163	10,975	6,151	10,965	17,212
% of total bed days	3%	4%	2%	4%	6%
% of total ACSC bed days	8%	10%	6%	10%	16%

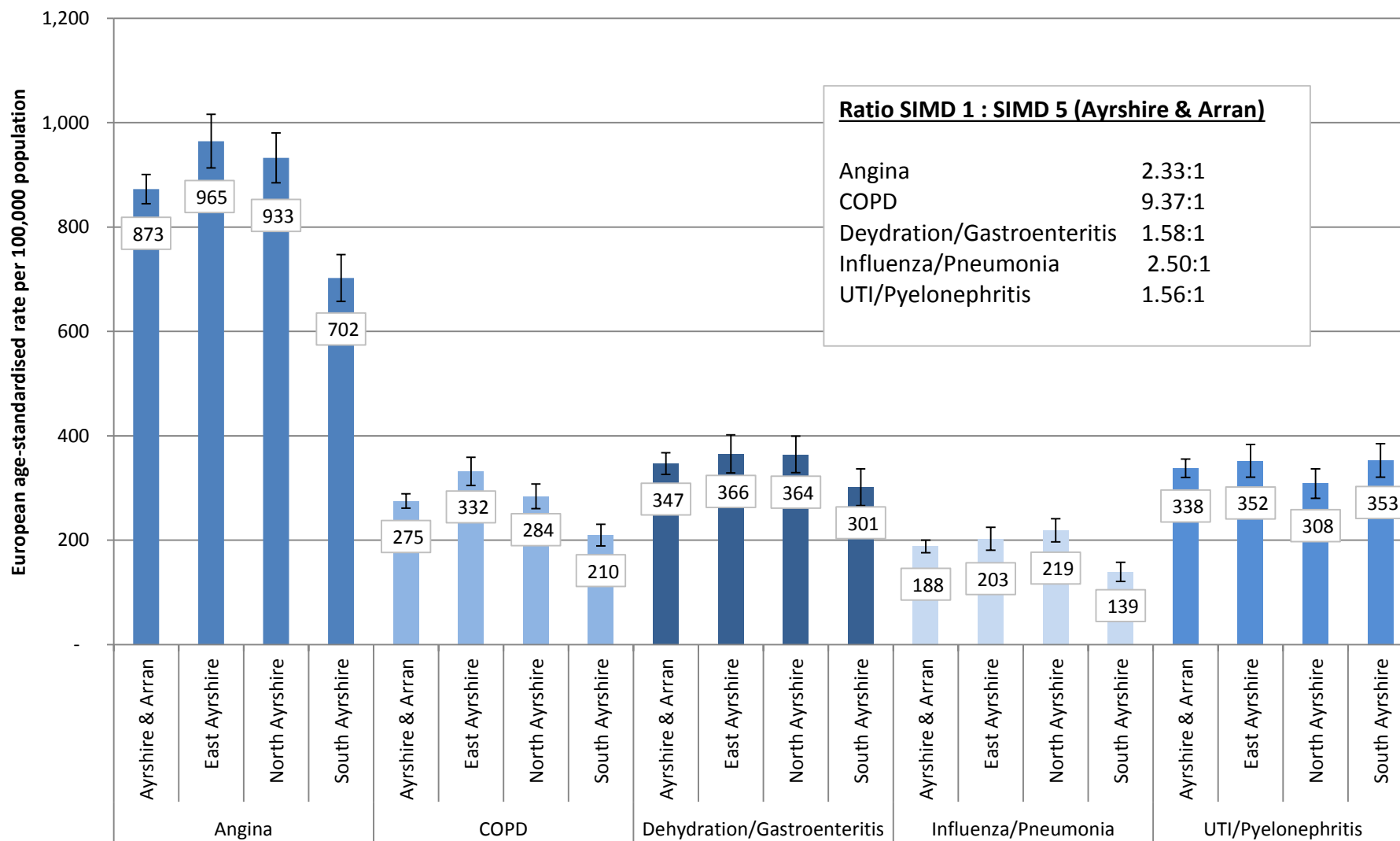
Age specific rates for four of the top five ACSC categories all increase across the life course, albeit with different trajectories (Figure 5). Angina admission rates begin to increase after age 14 then peaks at 80-84 years. UTI/pyelonephritis is relatively common among 0-4 years with a sharp drop afterwards. Age specific rates rise again between 5-9 and 20-24 years but are then quite stable prior to large increases among older people. COPD is rare until around 40 years, with age specific rates increasing more sharply around 60 years. Influenza/pneumonia follows a similar trajectory but increases sharply later at around 70 years. Dehydration and gastroenteritis was the only top five category which was more prevalent among young children (0-4 years) than older people. While dehydration and gastroenteritis rates were higher among older people than working age adults they did not increase as rapidly as the other top five categories.

Figure 5: Age specific rates per 100,000 population of continuous inpatient stays resulting from an emergency admission with primary diagnosis classed as ACSC 2013/14; by top 5 categories



Lower age standardised rates were observed in South Ayrshire for three of the top five ACSC categories, with the exception of dehydration/gastroenteritis and UTI/pyelonephritis (Figure 6). In East Ayrshire, higher rates were observed for angina and COPD. Age standardised rates for the top four ACSC categories in North Ayrshire did not appear to significantly differ from the Ayrshire and Arran average. A deprivation gradient was evident for all five categories, however, the ratio between most and least deprived quintile differed between ACSC categories. The difference between most and least deprived quintiles was greatest for COPD (almost 10 admissions in SIMD1 per 100,000 population for every 1 per 100,000 in SIMD5), while the smallest difference between most and least deprived quintiles was observed for UTI/pyelonephritis (about 1.6 admissions per 100,000 population in SIMD1 for every one admission per 100,000 population).

Figure 6: European age standardised rates per 100,000 population of continuous inpatient stays resulting from an emergency admission with primary diagnosis classed as ACSC 2013/14; by top five categories and HSCP area



4.2 Preventable neoplasms

Key messages

3% of emergency admissions were classed as preventable neoplasms.

No significant differences were apparent between the Health & Social Care Partnership areas.

There was an age standardised ratio of 2.1 admissions per 100,000 population in the most deprived SIMD quintile for every one admission per 100,000 among the least deprived quintile.

The age standardised rate for emergency admissions with a diagnosis classed as a preventable neoplasm among Ayrshire and Arran residents during 2013/14 was 239 per 100,000 population (Figure 7). No significant differences were apparent between the Health & Social Care Partnership areas. Rates of admission were highest among older people, with no admissions recorded among children and young people (Figure 8). Again a deprivation gradient was observed, with Ayrshire and Arran residents living within the most deprived quintile recording an age standardised ratio of 2.1 admissions per 100,000 population for every one admission per 100,000 among the least deprived quintile.

Figure 7: European age standardised rates per 100,000 population of continuous inpatient stays resulting from an emergency admission classed as preventable neoplasm (any position) 2013/14; persons aged 0-74 years by HSCP area

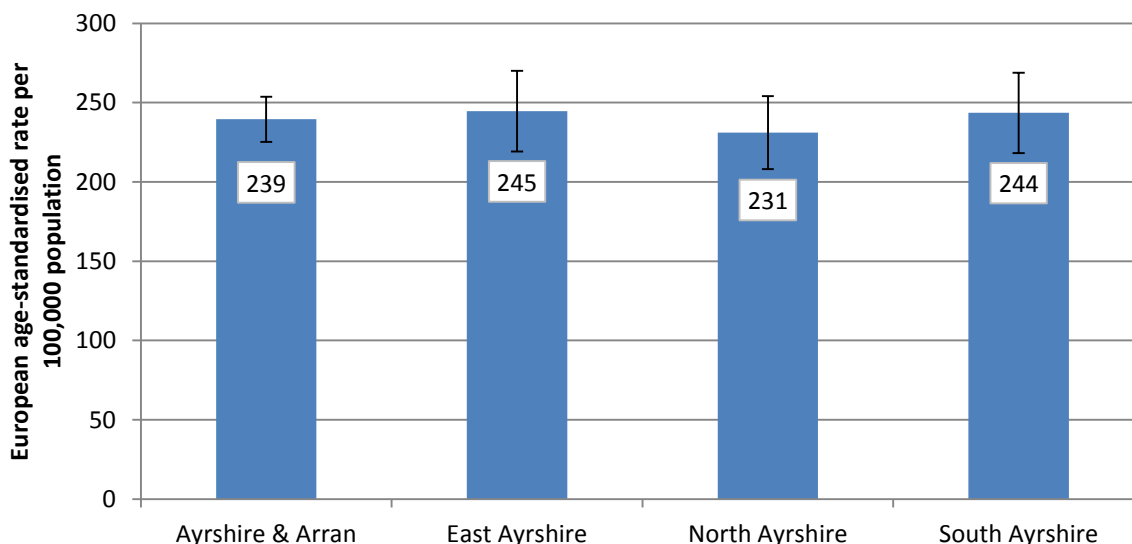
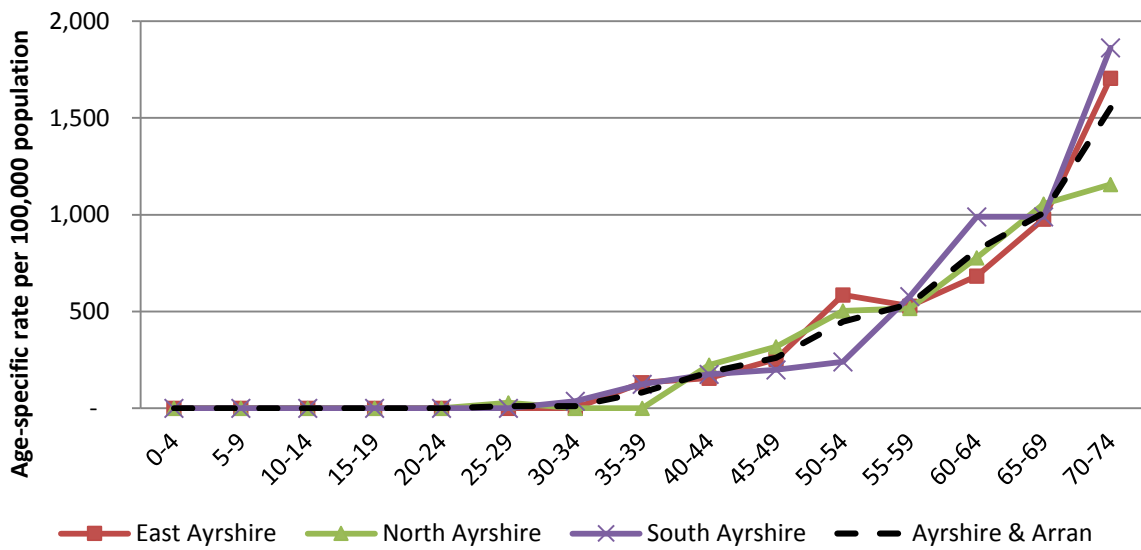


Figure 8: Age specific rates per 100,000 population of continuous inpatient stays resulting from an emergency admission classed as preventable neoplasm (any position) 2013/14; by HSCP area



4.3 Injuries

Key messages

16% of emergency admissions were classed as injuries.

No significant differences were apparent between the Health & Social Care Partnership areas.

Unintentional injury follows a similar pattern to ACSC classifications of avoidable admission presented in this report with respect to age, deprivation and locality distribution.

Intentional injuries are rare among children by comparison, but increase to a similar age specific rate as unintentional injury by 15-19 years but does not display the same sharp increase in older age groups observed for unintentional injury or other causes of avoidable admission.

Both types of injury are more common in areas of greater deprivation, with the deprivation gradient much more pronounced for intentional injuries among working age adults.

Admissions for falls among people aged 65 years and older would be classed as avoidable through management within primary care or community services, equating to 4% of all emergency admissions.

The age standardised rate for emergency admissions classed as unintentional injuries among Ayrshire and Arran residents during 2013/14 was 1,168 per 100,000 population, while the rate for intentional injury was 664 per 100,000 population (Figure 9). There does not appear to be huge variation in age standardised rates for unintentional and intentional injuries across Ayrshire & Arran, although North Ayrshire was found to have a higher rate for both types of injury than South Ayrshire. There is, however, a clear deprivation gradient for both categories of injury - with intentional injury having a higher ratio (3.8 emergency admissions per 100,000 pop in SIMD1 for every 1 per 100,000 in SIMD 5, compared with 1.98:1 for unintentional injury).

Unintentional injury follows a similar age distribution to other classifications of avoidable admission presented in this report (Figure 10). Age specific rates start relatively high among 0-4 years before dropping and remaining fairly stable until around 65 years, after which it increases rapidly.

Intentional injuries are rare among children by comparison, but increase to a similar age specific rate as unintentional injury by 15-19 years. They remain at a similar rate until around 40 years after which intentional injury decreases slightly. There appears to be a slight increase in intentional injury rates among older people, but not of the same sharp increase observed for unintentional injury or other causes of avoidable admission.

Figure 9: European age standardised rates per 100,000 population of continuous inpatient stays resulting from an emergency admission classed as unintentional or intentional injury (position 2-6) 2013/14; by HSCP area

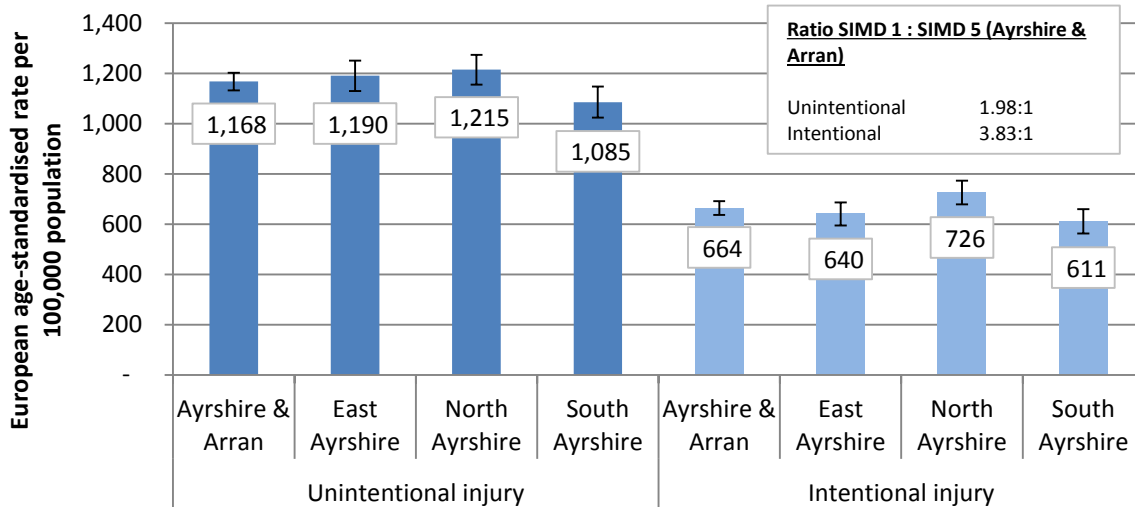
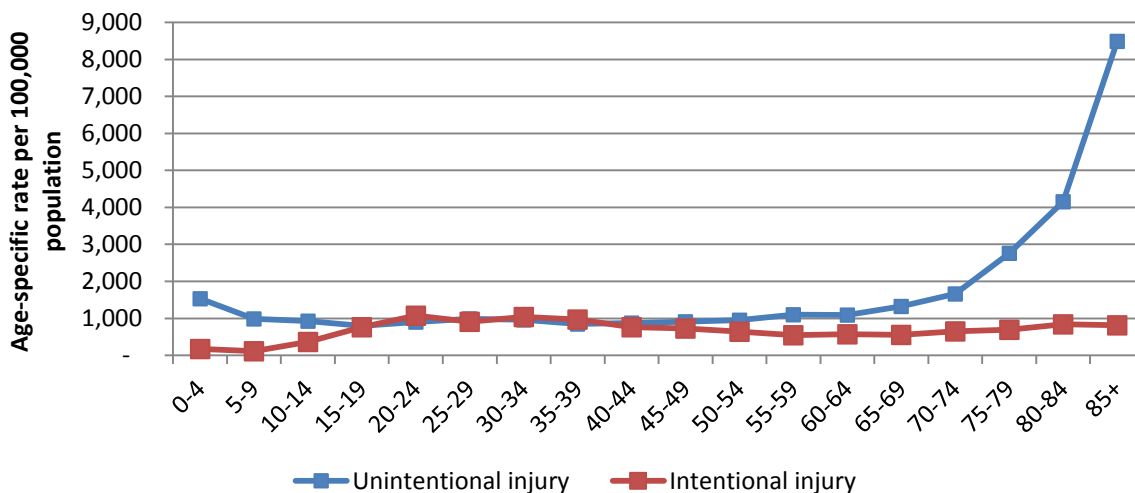


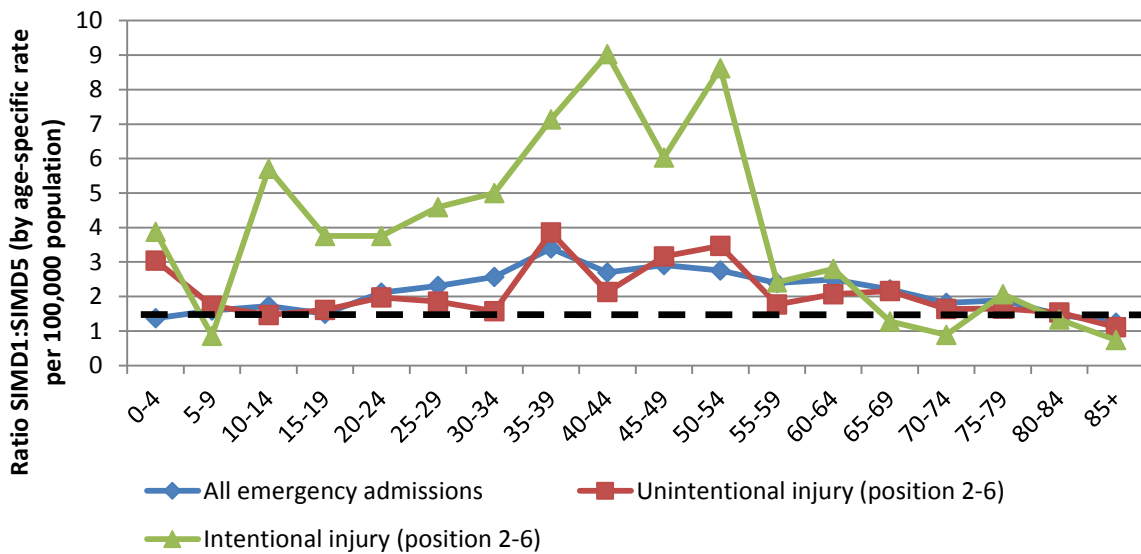
Figure 10: Age specific rates per 100,000 population of continuous inpatient stays resulting from an emergency admission classed as unintentional or intentional injury (position 2-6) 2013/14



The ratio of injury-related admissions between most and least deprived quintile within Ayrshire and Arran during 2013/14 by age specific rate per 100,000 population are presented in Figure 11. Both classifications of injury show a higher ratio of most to least deprived among 0-4 years compared with emergency admissions as a whole³. However, while unintentional injuries follow a similar trend to overall emergency admissions over the rest of the life course, the deprivation gradient is much more pronounced for intentional injuries for most of the working age adult period. From 55-59 years onwards, the age specific deprivation ratio for intentional injury falls back in line with that for emergency admissions overall.

³ The number of emergency admissions coded as intentional injuries among children is small and may be subject to annual variation.

Figure 11: Ratio (SIMD1:SIMD5) of injury-related admissions within Ayrshire and Arran during 2013/14 by age specific rate per 100,000 population



4.3.1 Falls

Falls account for a large proportion of injury-related emergency admissions and are often seen as avoidable through falls prevention interventions. There were 3,178 admissions coded as falls, which account for 7% of all emergency admissions. However, it is unlikely that all these falls could have been prevented through management within Primary Care or Community Services.

In terms of avoidable admissions as defined by the ACSC classification (Purdy et al 2009), there were very few admissions with an ACSC primary diagnosis and a falls code in position 2-6 (n=696). Sixty-six per cent (n=457) of these ACSC/falls admissions are for fractured proximal femur. Fractured proximal femur is the only ACSC category which would occur as the result of an injury. This is likely to be because hip fractures predominantly occur among older people and is a type of fracture with a clear target population and prevention measures. Other fall-related injuries among older people may be amenable to falls prevention interventions, however, there will be other admissions in children and working age adults with the same primary diagnosis that could not be avoided through Primary Care or Community Services management. The other ACSC categories associated with a fall code are more likely to have caused or contributed to the fall. Therefore, these falls would be avoided by preventing the primary condition rather than by fall prevention activities.

If we assume that falls-related admissions are only avoidable through falls prevention interventions within Primary Care or Community Services among those aged 65 years and older, just 4% of emergency admissions would be classed as avoidable. This figure is the current best estimate of falls' contribution to avoidable admissions.

5 Evidence for Models of Care to prevent avoidable hospital admissions

There is evidence that a number of interventions are successful in **reducing** avoidable admissions (see Table 3), including:

- Interventions at A&E: review by senior clinician and GP-led assessment units for urgent referrals from community GPs.
- Integrated Clinical Care programmes for heart failure, COPD, Asthma and Diabetes
- Exercise-based rehabilitation for CHD and COPD
- Case management for Heart Failure
- Home visits (plus telephone support) for heart failure patients; pregnant women with hypertension and/or diabetes, and in mental health patients
- Self-management, including practitioner review, in asthma and COPD patients
- Specialist clinics for heart failure patients
- Assertive Community Treatment for mental health patients
- Managed Clinical Networks (MCN) in patients with angina and diabetes
- Tele-related health care in older people and in people with heart failure, CHD, hypertension and diabetes

A number of interventions have been shown to **increase** avoidable admissions, including:

- Hospital at Home for a range of patient types that would otherwise require in-patient care.
- Integrated Care Packages that comprise horizontal integration between health and social care.

A full list of interventions, including those that did not affect admissions or those as yet unproven, can be seen in Table 3. The literature review has highlighted several key points for consideration in developing models of care locally. These include:

- More than 70% of avoidable admissions are significantly associated with measures of deprivation, so interventions must reflect this.
- As most avoidable admissions are due to a range of factors, no single model or intervention will be effective in reducing admission rates, therefore a whole-systems approach will be required.
- There is a clear need to develop robust evaluation, both local and national if possible, when introducing any new models of care without a robust evidence base.

The Public Health Department has extensively evaluated Community Wards and Intermediate Care and Enablement Services locally, including literature review. The Community Ward report is available on request, and the ICES evaluation report is due to be published in October 2014.

5.1 Caveats for Decision Makers

A systematic review is an approach taken where all the peer-reviewed studies on a given topic are reviewed against an agreed set of criteria, including, robustness of study design and errors in the analysis and interpretation of the findings. Studies judged to contain such errors are excluded from a systematic review. By carefully weighing the evidence from good quality studies together, a systematic review should come to an overall conclusion about the likelihood that an intervention or treatment is effective. The rapid review-of-reviews contained in this report about interventions to reduce avoidable admissions relied on a series of systematic reviews.

However, there are some limitations to this approach. The main one is that studies to evaluate new interventions or services are often very different in their design. This is often because the services themselves are very different from each other. Because the services and the studies to evaluate them are so variable, it is difficult to draw very firm conclusions about their impact in reducing avoidable admissions.

The second limitation is that the new models of service for reducing hospital admissions tend to be made up of many different elements. There may, for example, be involvements from a range of healthcare professionals. There may also be involvement from different sectors like; the health service, social services and the voluntary sectors. This means that it is difficult to identify which elements of the overall model are effective in reducing avoidable admissions or those elements which may be acting as a barrier to reducing these admissions.

The third caveat is about studies that are rejected from the systematic reviews. A systematic review may start by considering dozens of studies but will reject a lot of these because of concerns about the quality of the study. This means that there is a risk that some interventions for reducing avoidable admissions that might actually work in Ayrshire and Arran were discounted from the review.

Another challenge in undertaking a review of different interventions around avoidable admissions is that the authors of original studies may define the interventions differently. So, for example, a systematic review about 'case management' may include studies where this is defined solely as direct clinical care for patients in a clinical setting whereas in other studies case management can also include telecare, home visits and regular scheduled visits to a patients GP. This could result in contradictory findings between systematic reviews where one review reports an intervention is effective whilst a different review may report the opposite.

There is an additional matter to consider about the interventions presented here. These interventions were evaluated only for their effect on reducing avoidable admissions. However, the interventions included in this report often resulted in improvements in other health-related outcomes, as well as reductions in costs and improvements in both patient and staff experiences.

Table 3: Evidence of impact of models of care / interventions in reducing avoidable hospital admissions (AHA). Symbols: reduce AHA (↓); increase AHA (↑) and no effect on AHA (↔).

Models of care to prevent AHA	Condition	Impact on AHA	Other Outcomes
A&E Interventions	Review by senior clinician	↓	
	Social care presence	Lack of UK evidence	
	Assessment Units – Adult	↓	Rduces LoS, but patient-focussed outcomes unclear. Some evidence of financial savings
	Assessment Units – Children	↓	Especially for asthma
Assertive Community Treatment	Patients with SMI	↓	
Case Management	Older People	↔	Some evidence of reduction in LoS and costs
	Heart failure	↓	
	COPD	↔	
Care Pathways & Guidelines	Gastrointestinal Surgery	Inconclusive	Can reduce LoS
	Heart Disease	↓ (weak)	
	Stroke	Inconclusive	
	CAP	Inconclusive	
	Asthma (children)	Inconclusive	Can reduce LoS and costs
Community Interventions / Home Visits	Older People	Inconclusive	Positive impact on mortality, health and wellbeing, economic benefit unproven
	Heart Disease	↓ (weak)	
	Heart Failure readmissions	↓	Can reduce HF-AHA but not all-cause AHA, and has mortality benefit
	High-risk pregnant women	↓ (weak)	

Models of care to prevent AHA	Condition	Impact on AHA	Other Outcomes
Community Interventions / Home Visits	Mental Health Patients	↔	Reduction in time spent in hospital
Discharge Planning (structured)	All	↓	Also reduces LoS and increases patient satisfaction
	Elderly	↓	Only if home follow-up included
Falls Prevention	Older people	↔	Limited data in at-risk people
Hospital at Home	Elderly – Stroke	↑	Non-significant mortality reduction.
	Elderly – COPD	↑	Non-significant mortality reduction.
	End-of-Life	↔	Patients aged 18-plus
Integrated Health & Social Care Packages	General	↑	Balanced by reduction in elective admissions and outpatient attendance, cost neutral. Low patient acceptability.
	Elderly at-risk ^{\$}	↑↑	Balanced by reduction in elective admissions and outpatient attendance; ^{\$} of A&E admission
Integrated clinical care packages	Heart Failure	↓↓	
	COPD	↓↓	
Integrated clinical care packages	Asthma	↓	
	Diabetes	↓	
Managed Clinical Networks (for ACSC)	Heart Failure	↔	Impact of voluntary versus mandated MCN
	Angina	↓	Impact of voluntary versus mandated MCN
	Diabetes	↓	Impact of voluntary versus mandated MCN

Models of care to prevent AHA	Condition	Impact on AHA	Other Outcomes
Pharmacist Medicine review	Older People	↔	
	Heart failure*	↔	
	Asthma*	↔	
	Older people with HF	↓	Predischarge review plus post-discharge follow-up
Rehabilitation & exercise	COPD (pulmonary)	↓↓	
	Heart Disease	↓	Especially when exercise-based
	Hip fracture	↔	
	Older people – falls	↔	
	Older people – general health	↔	But cost savings and improved QAL
	Stroke	↔	
Self-management & Education	Asthma (adults)	↓	
Self-management & Education	COPD (adults)	↓	Especially when combined with practitioner review
	Heart Disease	↓ (weak)	
	Older people	↓ (weak)	Single RCT only
Self-management & Education	Heart Failure readmissions	↔	
Specialist Clinics	Older People	↔	
	Heart failure	↓	Both admissions and readmissions, especially when combined with home visits; had mortality benefit.
	Asthma	↔	Hampered by poor quality of evidence

Models of care to prevent AHA	Condition	Impact on AHA	Other Outcomes
Telemedicine/telehealth	Heart disease	↓ (weak)	
	Heart failure	↓ (weak)	
	Diabetes	↓ (weak)	
	Hypertension	↓ (weak)	
	Older people	↓ (weak)	In older people with LTC
	Severe asthma	↓	No impact on A&E visits or QAL
	COPD	↓	Reduction in A&E visits, no impact on QAL or mortality
Telemonitoring (remote sensing)	HF readmissions	↔	No mortality benefit
Vaccination programmes	Asthma	↔	Influenza vaccination - data limited
	Over-65s	Poor evidence	Influenza vaccination - data limited
	COPD	↔	Pneumococcal or Influenza vaccination
	Healthcare workers of elderly	↔	Data limited

SMI = severe mental illness; LoS = length of stay; QAL = quality of life; HF = heart failure; LTC = long-term conditions; CAP = community-acquired pneumonia; COPD = Chronic obstructive pulmonary disease; RCT = randomised controlled trial.

6 Summary review of literature: reducing emergency admissions in the top five ambulatory care sensitive conditions

This section provides an overview of the current evidence base for interventions that have the potential to reduce avoidable emergency admissions for the top five ambulatory care sensitive conditions in Ayrshire and Arran. The most well researched area with most robust evidence is the prevention of admissions due to COPD exacerbations. For the other four conditions we have provided some insight into interventions which show promise in terms of their ability to reduce avoidable admissions.

6.1 Angina

Use of sophisticated (and therefore sensitive) risk stratification system shows promise in enabling prompt discharge home of those patients identified as very low risk of adverse cardiac events – around 30%.

6.2 UTI and Pyelonephritis

There is scant evidence regarding interventions to prevent admission in this group of patients. One study reported very positive results for patients treated using a specific pyelonephritis protocol in the emergency department.

6.3 COPD

There is good evidence for a number of interventions that can reduce emergency admissions for COPD exacerbations:

- The most effective intervention for patients with COPD is to stop smoking.
- The step wise approach to drug therapy as outlined in the NICE Guideline for COPD is evidence based and is recommended.
- Pulmonary rehabilitation is very effective in reducing hospital admissions and mortality and should be available to all patients with moderate to severe COPD and within a week of hospital discharge following an exacerbation.
- Influenza vaccination was associated with a reduction in exacerbations of COPD.
- Provision of rescue medications in the management of COPD exacerbations shows promise in reducing admission rates.

6.4 Dehydration or gastroenteritis

There is very little literature available on this area.

6.5 Pneumonia

The available research focuses on risk stratification of patients presenting at the emergency department with the aim of assessing and identifying low risk to reduce avoidable admission. Risk stratification was achieved with a range of clinical practice

guidelines and risk severity index systems that scored patients. It was concluded that patients assessed at low risk through a rigorous system and treated with adherence to recommended antibiotic regimens could be managed safely within the community

6.6 Influenza

There is very little literature available to draw robust conclusions.

7 Conclusion

The intention of this report was primarily to provide planners within Health and Social Care Partnerships with an enhanced understanding of:

1. the current state of emergency admissions in Ayrshire and Arran
2. what proportion of these emergency admissions could have been avoided if optimal primary, community or social care systems were in place
3. effective models of care for reducing avoidable admissions.

The scope of this report has been limited to these three areas. However, we must not lose sight of the important role of disease prevention. There is a preventable element to each of the top reasons for avoidable admission, to a varying degree. We have illustrated the proportion of emergency admissions due to preventable neoplasms and injuries, so there is clearly a role for more upstream prevention.

The findings of this report have implications for service planning and our main recommendation is that Health and Social Care Partnership planners and decision makers read this report, and use the findings to inform strategic planning.

References

- Allen D, Gillen E & Rixson L. (2009) Systematic review of the effectiveness of integrated care pathways: what works, for whom, in which circumstances? *Int J Evid Based Healthc.* 7(2):61-74. doi: 10.1111/j.1744-1609.2009.00127.x.
- Anonymous (2005) Outpatient treatment as effective as inpatient for many with pneumonia. *J.Fam.Pract.* 2005 54 (5) pp406.
- Anonymous (2010) Preventing exacerbations in COPD. *Drug & Therapeutics Bulletin* 2010 48 (7) pp74-77.
- Aziz NA, Leonardi-Bee J, Phillips MF et al (2008). Therapy-based rehabilitation services for patients living at home more than one year after stroke (Review). *Cochrane Database Syst Rev.* Issue 2, Art No: CD005952.
- Bardsley M, Blunt I, Davies S et al (2013). Is secondary preventive care improving? Observational study of 10-year trends in emergency admissions for conditions amenable to ambulatory care. *BMJ Open.* 3:e002007.
- Benbassat J & Taragin MI. (2013) The effect of clinical interventions on hospital readmissions: a meta-review of published meta-analysis. *Isr J Health Pol Res.* 2(1):1-15.
- Bird, S., Noronha, M. and Sinnott, H. (2010) An integrated care facilitation model improves quality of life and reduces use of hospital resources by patients with chronic obstructive pulmonary disease and chronic heart failure. *Australian Journal of Primary Health* 2010 16 (4) pp326-333.
- Body, R., Carley, S. D., Burrows, G.(2012) The Manchester acute coronary syndromes (MACs) decision rule to reduce unnecessary admissions for cardiac chest pain: Derivation and external validation. *Academic Emergency Medicine* 2012 19 (6) pp744.
- Burns T, Knapp M, catty J et al. (2001) Home treatment for mental health problems: a systematic review. *Health Tech Ass.* 5(15):
- Campbell, F., Armstrong, N., Morgan, D., et al. (2013) Remote telehealth monitoring: Hope on the horizon for hospital admission prevention? *Ir.J.Med.Sci.* 2013 182 ppS474.
- Campbell, S. G., Patrick, W., Urquhart, D. G., et al. (2004) Patients with community acquired pneumonia discharged from the emergency department according to a clinical practice guideline. *Emergency Medicine Journal* 2004 21 (6) pp667-669.
- Challen, K., Goodacre, S. W., Wilson, R., et al. (2012) Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission. *Emergency Medicine Journal* 2012 29 (5) pp383-388.
- Chuang, C., Levine, S. H. and Rich, J. (2011) Enhancing cost-effective care with a patient-centric coronary obstructive pulmonary disease program. *Population Health Management* 2011 14 (3) pp133-136.
- Cooke MW, Higgins J & Kidd P. (2003) Use of emergency observation and assessment wards: a systematic literature review. *Emerg Med J.* 20:138-142.
- Culy, A., Roberts, D., Liew, J., et al. (2010) The role of rescue medications in the management of COPD exacerbations. *Clinical Pharmacist* 2010 2 (9) ppS5-S6.

- Dajczman, E., Robitaille, C., Ernst, P., et al. (2013) Integrated interdisciplinary care for patients with chronic obstructive pulmonary disease reduces emergency department visits, admissions and costs: a quality assurance study. *Canadian Respiratory Journal* 2013 20 (5) pp351-356.
- Dambrava, P. G., Torres, A., Valles, X., et al. (2008) Adherence to guidelines' empirical antibiotic recommendations and community-acquired pneumonia outcome. *European Respiratory Journal* 2008 32 (4) pp892-901.
- Dewan, N. A., Caldwell, M. C., Rice, K. L., et al. (2010) Cost effective analysis of disease management in COPD: Results of a 23 multicenter randomized controlled trial. *American Journal of Respiratory and Critical Care Medicine* 2010 181 (1 Meeting Abstracts)
- Dieterich M, Irving CB, Park B, et al (2010). Intensive case management for severe mental illness. *Cochrane Database Syst Rev* Issue 10. Art. No.: D007906. DOI: 10.1002/14651858.CD007906.pub2.
- Feltner C, Jones CD, Cene CW, et al. (2014). Transitional care interventions to prevent readmissions for persons with heart failure: A systematic review and meta-analysis. *Ann Intern Med.* 160: 774-784.
- Fitzsimmons, D. A., Thompson, J., Hawley, M., et al. (2011) Preventative tele-health supported services for early stage chronic obstructive pulmonary disease: a protocol for a pragmatic randomized controlled trial pilot. *Trials [Electronic Resource]* 2011 12 pp6.
- Goodacre, S., Cross, E., Lewis, C., et al. (2007) Effectiveness and safety of chest pain assessment to prevent emergency admissions: ESCAPE cluster randomised trial. *BMJ* 2007 335 (7621) pp659.
- Goodacre, S., Challen, K., Wilson, R., et al. (2010) Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission: cohort study. *Health Technol. Assess.* 2010 14 (46) pp173-236.
- Guthrie B, Davies H, Grieg G. Et al. (2010). Delivering health care through managed clinical networks (MCNs): lessons from the North. SDO Project (08/1518/103).
- Hansen LO, Young RS, Hinami K, et al. (2011). Interventions to reduce 30-day rehospitalisation: A systematic review. *Ann Intern Med.* 155:520-528.
- Haustein, T., Harris, J. P., Pebody, R., et al. (2009) Hospital admissions due to Norovirus in adult and elderly patients in England. *Clinical Infectious Diseases* 2009 49 (12) pp1890-1892.
- Hawley, C. (2010) Managing patients with recent onset chest pain: What should we do? *Primary Care Cardiovascular Journal* 2010 3 (3) pp137-142.
- Health Quality Ontario. (2013). In-home care for optimizing chronic disease management in the community: an evidence-based analysis. *Ont Health Technol Assess Ser.* 13(5):1–65.
- Hogan DB, Amuah JE, Strain LA. (2014) High rates of hospital admission among older residents in assisted living facilities: opportunities for intervention and impact on acute care. *Open Medicine.* 8 (1).
- Howard RL, Avery AJ, Slavenburg JS, et al. (2006) Which drugs cause preventable admissions to hospital? A systematic review. *Br J Clin Pharmacol.* 63 :2 136–147.

- Huntley AL, Thomas R, Mann M, et al (2013) Is case management effective in reducing the risk of unplanned hospital admissions for older people? A systematic review and meta-analysis. *Fam Prac.* 2013; **30**:266–275.
- Ingram, P. R., Cerbe, L., Hassell, M., et al. (2008) Limited role for outpatient parenteral antibiotic therapy for community-acquired pneumonia. *Respirology* 2008 **13** (6) pp893-896.
- Jeppesen E, Brurberg KG, Vist GE, et al. (2012). Hospital at home for acute exacerbations of chronic obstructive pulmonary disease (Review). *Cochrane Database Syst Rev* Issue 5. Art. No.: CD003573.
- Jo, S., Kim, K., Jung, K., et al. (2012) The effects of incorporating a pneumonia severity index into the admission protocol for community-acquired pneumonia. *J.Emerg.Med.* 2012 **42** (2) pp133-138.
- Johnstone, J., Majumdar, S. R. and Marrie, T. (2008) The value of prognostic indices for pneumonia. *Curr.Infect.Dis.Rep.* 2008 **10** (3) pp215-222.
- Julian-Jimenez, A., Gonzalez-Castillo, J. and Candel Gonzalez, F. J. (2013) When, where and how should a patient with community acquired pneumonia be admitted? *Rev.Clin.Esp.* 2013 **213** (2) pp99-107.
- Kang, C., Kim, K., Lee, S. H., et al. (2013) A risk stratification model of acute pyelonephritis to indicate hospital admission from the ED. *Am.J.Emerg.Med.* 2013 **31** (7) pp1067-1072.
- Katz, D. A., Dawson, J., Beshansky, J. R. (2007) Does concordance with guideline triage recommendations affect clinical care of patients with possible acute coronary syndrome? *Medical Decision Making* 2007 **27** (4) pp423-437.
- Khachi, H., Hodson, M., Welsby, V., et al. (2012) Impact of implementing COPD self management plans & rescue medications across 3 hospitals. *Thorax* 2012 **67** ppA172-A173.
- Kim, K., Lee, C. C., Rhee, J. E., et al. (2008) The effects of an institutional care map on the admission rates and medical costs in women with acute pyelonephritis. *Acad.Emerg.Med.* 2008 **15** (4) pp319-323.
- Kuster, S. P., Katz, K. C., Blair, J., et al. (2011) When should a diagnosis of influenza be considered in adults requiring intensive care unit admission? Results of population-based active surveillance in Toronto. *Crit.Care* 2011 **15** (4) ppR182.
- Labarere, J., Stone, R. A., Obrosky, D. S., et al. (2006) Factors associated with the hospitalization of low-risk patients with community-acquired pneumonia in a cluster-randomized trial. *Journal of General Internal Medicine* 2006 **21** (7) pp745-752.
- Linertova R, Garcia-Perez L, Vasques-Diaz JR, et al (2011). Interventions to reduce hospital readmissions in the elderly: in-hospital or home care. A systematic review. *J Eval Clin Prac.* **17**: 1167-1175.
- Low L-F, Yap M & Brodaty H. (2011) A systematic review of different models of home and community care services for older persons. *BMC Health Ser Res.* **11**:93.
- Mandell, L. (2005) Decisions about treating community-acquired pneumonia. *Ann.Intern.Med.* 2005 **142** (3) pp215-216.

- Marshall M, Lockwood A. (2011) Assertive community treatment for people with severe mental disorders. *Cochrane Database Syst Rev.* 13;(4):CD001089. doi: 10.1002/14651858.CD001089.pub2.
- Martinez-Gonzalez NA, Berchtold P, Ullman K et al. (2014). Integrated care programmes for adults with chronic conditions: a meta-review. *Int J Qual Health Care.* 26:1-10. 10.1093/intqhc/mzu071.
- McLean, S, Chandler D, Liu JL, et al. (2012) Telehealthcare for chronic obstructive pulmonary disease: Cochrane Review and meta-analysis. *Br J Gen Pract.* 62(604):e739-49. doi: 10.3399/bjgp12X658269.
- McLean, S, Chandler D, Nurmatov U et al. (2011) Telehealthcare for asthma: a Cochrane review. *Can Med Ass J.* 183(11): E733–E742
- McMartin K. (2013) Discharge planning in chronic conditions: an evidence-based analysis. *Ont Health Technol Assess Ser.* 13(4):1–72.
- Moore, R. K. G., Groves, D. G., Bridson, J. D., et al. (2007) A Brief Cognitive-Behavioral Intervention Reduces Hospital Admissions in Refractory Angina Patients. *J.Pain Symptom Manage.* 2007 33 (3) pp310-316.
- Muller, M. P., McGeer, A. J., Hassan, K., et al. (2010) Evaluation of pneumonia severity and acute physiology scores to predict ICU admission and mortality in patients hospitalized for influenza. *PLoS ONE* 2010 5 (3) , 2010 ppate of Pubaton: 05 Mar 2010.
- Myles, P. R., Nguyen-Van-Tam, J. S., Lim, W. S., et al. (2012) Comparison of CATS, CURB-65 and PMEWS as triage tools in pandemic influenza admissions to uk hospitals: Case control analysis using retrospective data. *PLoS ONE* 2012 7 (4) , 2012 ppate of Pubaton: 03 Ar 2012.
- National Institute for Health and Care Excellence (2010) *NICE guidelines CG101: Chronic obstructive pulmonary disease - Management of chronic obstructive pulmonary disease in adults in primary and secondary care.* National Institute for Health and Care Excellence.
- National Institute for Health and Care Excellence (2011) *NICE guidelines CG126: Management of stable angina.* National Institute for Health and Care Excellence.
- National Institute for Health and Care Excellence (2013) *Clinical Knowledge Summary: Pyelonephritis – acute.* National Institute for Health and Care Excellence.
- NHS England (2014). *Emergency Admission Technical Paper: Understanding drivers of emergency admissions for ambulatory care-sensitive conditions.* NHS England.
- O’Cathain A, Knowles E, Maheswaren R, et al (2014) A system-wide approach to explaining variation in potentially avoidable emergency admissions: national ecological study. *BMI Qual Saf.* 23:47-55.
- Office of National Statistics (2012) *Definition of avoidable mortality.* Office of National Statistics.
- Ogilvie D (2005) Hospital based alternatives to acute paediatric admission: a systematic review. *Arch Dis Child.* 90:138–142. doi: 0.1136/adc.2003.035543.

Ouwens M, Wollersheim H, Hermens R, et al. (2005). Integrated care programmes for chronically ill patients: a review of systematic reviews. *Int J Qual Health Care*. 17(2): 141-146.

Puhan MA, Gimeno-Sanchez E, Sharplatz M (2011) Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease (Review). *Cochrane Database Syst Rev* DOI: 10.1002/14651858.CD005305.pub3.

Puig-Barbera, J., Diez-Domingo, J., Perez Hoyos, S., et al. (2004) Effectiveness of the MF59-adjuvanted influenza vaccine in preventing emergency admissions for pneumonia in the elderly over 64 years of age. *Vaccine* 2004 23 (3) pp283-289.

Purdy S, Griffin T, Salisbury C, Sharp D (2009). Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians. *Public Health* 123: 169–173.

Purdy S (2010) Avoiding hospital Admissions: What does the research evidence say? The King's Fund, London.

Purdy S, Paranjthy A, Huntly A, et al. (2012) Interventions to reduce unplanned hospital admissions: a series of systematic reviews. NHS Bristol, Cardiff University and University of Bristol. *Unpublished Report*.

Purdy S & Huntly A (2013) Predicting and preventing avoidable hospital admissions: a review. *J Roy Coll Edinb*. 43:340-4.

RAND Europe (2012). National evaluation of the Department of health's Integrated Care Pilots. Cambridge, UK.

Rea, H., McAuley, S., Stewart, A., et al. (2004) A chronic disease management programme can reduce days in hospital for patients with chronic obstructive pulmonary disease. *Intern.Med.J.* 2004 34 (11) pp608-614.

Revitt, O., Sewell, L., Morgan, M. D. L., et al. (2013) Short outpatient pulmonary rehabilitation programme reduces readmission following a hospitalization for an exacerbation of chronic obstructive pulmonary disease. *Respirology* 2013 18 (7) pp1063-1068.

Rice, K. L., Dewan, N., Bloomfield, H. E., et al. (2010) Disease management program for chronic obstructive pulmonary disease a randomized controlled trial. *American Journal of Respiratory and Critical Care Medicine* 2010 182 (7) pp890-896.

Roberts A, Garrett L & Godden DJ. (2012). Can telehealth deliver for rural Scotland? Lessons learned from the Argyll & Bute telehealth programme. *Scot Med J*. 57:33-37.

Roland M, Lewis R, Steventon A, et al. (2012) Case management for at-risk elderly patients in the English integrated care pilots: observational study of staff and patient experience and secondary care utilisation. *Int J Integ Care*. Volume 12, DOI: [10-1-113731](https://doi.org/10.113731) / [ijic2012-130](https://doi.org/10.113731).

Rotter T, Kinsman L, James EL, et al. (2010). Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs. *Cochrane Database Sys Rev* 2010, Issue 3. Art.No.:CD006632. DOI: 0.1002/14651858.CD006632.pub2.

- Royal S, Smeaton L, Avery AJ, et al. (2006) Interventions in primary care to reduce medication related adverse events and hospital admissions: systematic review and meta-analysis. *Qual Saf Health Care*. 15:23–31. doi: 10.1136/qshc.2004.012153.
- Schrock, J. W., Reznikova, S. and Weller, S. (2010) The effect of an observation unit on the rate of ED admission and discharge for pyelonephritis. *Am.J.Emerg.Med.* 2010 28 (6) pp682-688.
- Schuur, J. D., Baugh, C. W., Hess, E. P., et al. (2011) Critical pathways for post-emergency outpatient diagnosis and treatment: Tools to improve the value of emergency care. *Acad.Emerg.Med.* 2011 18 (6) ppe52-e63.
- Scottish Government (2010) Clinical Standards: Chronic Obstructive Pulmonary Disease Services. NHS Quality Improvement Scotland.
- Shepperd S, Lannin NA, Clemson LM, et al. (2013) Discharge planning from hospital to home. *Cochrane Database Syst Rev*. Issue 1, Art No: CD000313.
- Shepperd S, Wee B & Straus SE. (2011) Hospital at home: home-based end of life care. *Cochrane Database Syst Rev*. Issue 7. DOI: 10.1002/14651858.CD009231.
- Shepperd S, Doll H, Angus RM, et al. (2008). Hospital at home admission avoidance. *Cochrane Database Syst Rev*. Issue 4, Art No: CD007491.
- Soncini, M., Russo, A., Campi, E., et al. (2010) Capsule endoscopy of the small bowel in the clinical practice: Outpatient management is feasible and cheaper. *Minerva Gastroenterol.Dietol.* 2010 56 (4) pp383-387
- Steventon A, Bardsley M, Billings J, et al. (2012) Effect of telehealth on use of secondary care and mortality: findings from the Whole System demonstrator cluster randomised trial. *Brit Med J* 344: e3874.
- Takeda A, Taylor SJC, Taylor RS, et al. (2012). Clinical service organisation for heart failure. *Cochrane Database Syst Rev* 2012, Issue 9. DOI: 10.1002/14651858.CD002752.pub3.
- Tappenden P, Campbell F, Rawdin A, et al. (2012) The clinical effectiveness and cost-effectiveness of home-based, nurse-led health promotion for older people: a systematic review. *Health Tech Ass.* 16(20):
- Taylor, R. and Marley, A. (2006) An integrated model for community COPD care. *Australian Journal of Primary Health* 2006 12 (2) pp45-50.
- Thomas R, Wilson DM, Birch S, et al. (2014a). Examining end-of-life case management: Systematic review. *Nurs Res Pract.* DOI: 10.1155/2014/651681.
- Thomas R, Huntley AI, Mann M, et al. (2014b) Pharmacist-led interventions to reduce unplanned admissions for older people: a systematic review and meta-analysis of randomised controlled trials. *Age and Ageing* 2014; 43: 174–187. doi: 10.1093/ageing/aft169.
- Thomas R, Huntley A, Mann M et al. (2013). Specialist clinics for reducing emergency admissions in patients with heart failure: a systematic review and meta-analysis of randomised controlled trials. *Heart* 99(4):233-9. doi: 10.1136/heartjnl-2012-302313.
- Van Walraven C, Bennett C, Jenings A, et al (2011). Proportion of hospital readmissions deemed avoidable: a systematic review. *Can Med Ass J.* 183(7):E391-399.

- Vest JR, Gamm LD, Oxford BA, et al. (2010) Determinants of preventable readmissions in the United States: a systematic review. *Imp Sci.* 5:88.
- Vitacca, M., Bianchi, L., Guerra, A., et al. (2009) Tele-assistance in chronic respiratory failure patients: A randomised clinical trial. *European Respiratory Journal* 2009 33 (2) pp411-418.
- Westfall, J. M., Van Vorst, R. F., McGloin, J., et al. (2006) Triage and diagnosis of chest pain in rural hospitals: Implementation of the ACI-TIPI in the High Plains Research Network. *Annals of Family Medicine* 2006 4 (2) pp153-158.
- Wong CX, Carson KV and Smith BJ (2012). Home care by outreach nursing for chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* Issue 4, DOI: 10.1002/14651858. CD000994.
- Wu T, Jen M, Bottle A et al (2010) Ten-year trends in hospital admissions for adverse drug reactions in England 1999–2009. *J R Soc Med* 103:239–250. DOI 10.1258/jrsm.2010.100113.
- Yealy, D. M., Auble, T. E., Stone, R. A., et al. (2004) The emergency department community-acquired pneumonia trial: Methodology of a quality improvement intervention. *Ann. Emerg. Med.* 2004 43 (6) pp770-782.