

Growth in nurse prescribing of antibiotics: the Scottish experience 2007-13

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1 **Title:** The growth in nurse prescribing of antibiotics: the Scottish experience 2007-
2 2013

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20 **Short running title:** nurse prescribing of antibiotics

21 **Key words (3-5):** nurse, prescribing, descriptive analysis

22 **Synopsis:**

23 Objective: To retrospectively analyse patterns of primary care antibiotic prescribing by
24 nurse prescribers in Scotland.

25 Patients and methods: Data on dispensed antibiotic prescriptions written by nurse
26 prescribers 2007-2013 were obtained from the Prescribing Information System, a
27 database of all NHS prescriptions dispensed in Scotland.

28 Results: Since 2007, there has been a steady increase in the volume of antibiotic
29 prescribing in primary care undertaken by nurse prescribers. There was considerable
30 variability in the frequency of antibiotic prescribing among nurses and across NHS
31 boards. Since 2007, an increasing proportion of antibiotics prescribed by nurses are
32 those recommended for first line empirical treatment of infection with a reduction in the
33 proportion of broader spectrum agents. Other measures of prescribing quality; duration
34 of treatment of adult females with urinary tract infection and use of recommended
35 doses have improved since 2007.

36 Conclusion: This paper is the first to present an analysis of data on antibiotic
37 prescribing in primary care by nurse prescribers. Inappropriate prescribing is a problem
38 and given the impact that antibiotic prescribing has on Antimicrobial Resistance (AMR)
39 it is important that the prescribing behaviour of nurses is explored. This is especially
40 significant as this is a growing body of prescribers who predominately work in the
41 community where the majority of antibiotics are prescribed. This analysis showed that
42 practice varies across NHS Boards and between prescribers and although more
43 information is needed to establish if nurse prescribers are prescribing appropriately,
44 some quality indicators may suggest that they are following best practice.

45

46

47 **Introduction**

48 Nurse prescribing has been implemented in several countries, including the United
49 States (US), Australia and Ireland; however, no other country has such extended
50 prescribing rights as the United Kingdom (UK).¹ In 2005, the Committee on Safety of
51 Medicines (CSM) concluded that suitably trained and qualified nurses should be able to
52 prescribe any medicine from the British National Formulary (BNF) provided the
53 prescriber is acting within their competence. This came into effect in 2006, with the
54 publication of “Non Medical Prescribing: Guidance for Independent Nurse Prescribers
55 and for Community Practitioner Nurse Prescribers in Scotland”² in Scotland, and the
56 Nursing & Midwifery Council “Standards of proficiency for nurse and midwife
57 prescribers” across the whole of the UK.³

58 There are three types of nurse prescribers; Supplementary Prescribers (based on a
59 partnership between the doctor and the nurse where the nurse has the ability to
60 prescribe a drug listed in a patient-specific clinical management plan once the patient
61 has been diagnosed by a doctor), Community Practitioner Nurse Prescribers (prescribe
62 from a limited formulary called the Nursing Formulary for Community Practitioners
63 which includes over-the-counter drugs, dressings and applications) and Nurse
64 Independent Prescribers. This final group can prescribe any licensed and unlicensed
65 drugs within their competence and therefore it is this group who are most likely to
66 prescribe antibiotics. At the time that this nurse prescribing development arose (2002),
67 the UK House of Lords debated the prescribing extensions with regard to the steps
68 needed to “guard against an increasing prevalence of antibiotic resistant organisms in
69 the light of the Nurse Prescribing Regulations”.⁴

70 The number of nurse prescribers in the UK (including supplementary, community
71 practitioner and independent prescribers), obtained from Nursing and Midwifery

72 Council (NMC) data received in October 2013, was 65080 (this includes 6514 nurse
73 prescribers in Scotland). These numbers have increased each year since 2006.⁵
74 Figures from NHS Education for Scotland suggests that, in 2013; around 2687 of these
75 prescribers in Scotland were independent prescribers.⁶ Evidence has arisen in the
76 intervening period indicating that nurse prescribing improves patient care, primarily
77 through patient convenience, time saving, improvement in adherence to medication
78 and the prevention of relapses due to greater involvement of the patient in the decision-
79 making about their care. ⁷⁻¹¹ It therefore seems likely that this increasing trend in the
80 prevalence of nurse prescribers will continue.

81 Antimicrobial resistance (AMR) is now an urgent public health concern and threatens to
82 reduce the effectiveness of how infections are treated.¹² Although the development of
83 AMR is a complex evolutionary process it is accepted that the driver for the
84 development of resistance is use of antibiotics and that resistance is greatest where
85 use is greatest.¹³ The scale of the threat from AMR and the case for action in the UK
86 was recently set out in a five year strategy¹⁴ and an action plan to deliver this in
87 Scotland was set out in “The Scottish Management of Antimicrobial Resistance Action
88 Plan 2014-18 (ScotMARAP2)”.¹⁵

89 Improving antibiotic prescribing is one of the fundamental objectives, featuring in both
90 strategy documents, in tackling AMR. The ScotMARAP2¹⁵ document recognises the
91 requirements to develop multi professional expertise in antimicrobial stewardship,
92 including non-medical prescribers in the light of emerging evidence of the influence of
93 this group of professionals.

94 A series of case studies¹⁶, involving nurse prescribers across acute and primary care
95 settings in Scotland, indicated that nurses may be well placed to optimise antibiotic
96 prescribing. This is due to the greater time spent with, and often knowledge of, the

97 patient and their accessibility to provide timely prescriptions. Nurses have always
98 played key roles in infection prevention and control and so it would seem appropriate
99 that they could have a role in controlling AMR through their prescribing behaviour and
100 their role in managing public expectations of the need for an antibiotic prescription.¹⁶
101 Nurse prescribers also have a key role in primary care, where 80% of antibiotic
102 prescribing occurs.¹⁷

103 Given the imminent risk to public health from AMR and the impact that antibiotic
104 prescribing has on this, it is important that nurse prescribing behaviour is explored;
105 however there is a paucity of published evidence on the subject of antibiotic prescribing
106 behaviour of nurse prescribers.¹⁸

107 Inappropriate antibiotic prescribing is a known problem in primary care;¹⁹ what is
108 unknown is the contribution of the growing body of nurse prescribers to this problem.
109 Nurse prescribers work in a variety of settings, but especially within primary care where
110 the majority of antibiotics are prescribed, thus understanding the prescribing
111 behaviours of this body of prescribers is of particular importance. Accordingly, this
112 paper aims to describe the quantitative patterns of primary care antibiotic prescribing
113 by nurse prescribers in Scotland.

114

115 **Methods**

116 This was a retrospective analysis of a national prescribing dataset of nurse prescribers'
117 practice over six years. The objectives of the analysis were to establish trends in the
118 number and type of antibiotic items prescribed, in the percentage of all primary care
119 prescribing, by NHS board and patient age group, and to explore compliance with
120 national prescribing guidance. Scotland consists of 14 geographically based local NHS
121 Boards which are responsible for the provision of community and hospital healthcare.

122 Data were obtained from the Prescribing Information System (PIS), an electronic
123 database containing details of all NHS prescriptions dispensed in the community in
124 Scotland. This is maintained by Information Services Division (ISD), part of NHS
125 National Services Scotland (NSS). The information is supplied to ISD by the
126 Practitioner and Counter Fraud Services strategic business unit of NSS who are
127 responsible for the processing and pricing of all prescriptions dispensed in Scotland.

128 Data were accessed by a Senior Data Analyst employed by ISD Scotland who has
129 permission to access this information. The other authors had no access to this raw
130 data. The dataset analysed was aggregated and anonymised in accordance with ISD
131 confidentiality rules and the Data Protection Act of 1998.²⁰ Outputs were produced by
132 the analyst which contained no patient or prescriber identifiable information, therefore
133 no ethical approval was required.

134 The PIS contains prescriber and dispenser information (geographical location) and
135 prescription details (name, strength, formulation, quantity and cost of medicine). Since
136 2009 an increasing proportion of NHS prescriptions contain an individual's Community
137 Heath Index (CHI) number thereby enabling analysis of prescribing information to be
138 broken down by patient demographics such as age and gender. A CHI capture rate is
139 always reported when presenting patient level analysis for reliability purposes.
140 Generally a rate of over 90% is considered high enough to allow accurate patient
141 analysis.²¹ The completeness of CHI, and any confounding effect this may have,
142 should be considered when interpreting the results.

143 Data on antibiotic prescribing in primary care presented in this report were derived from
144 prescriptions written by nurses on GP10N prescription forms dispensed in the
145 community. GP10N prescription forms are specific NHS prescription forms used by
146 nurse prescribers. Data on nurse prescribing arising from Out of Hours Centres were

147 excluded due to differences in service delivery and access to medicines. Only data on
148 systemic antibiotics in BNF section 5.1 (antibiotic drugs), excluding 5.1.9
149 (antituberculosis drugs) and 5.1.10 (antileprotic drugs) except streptomycin were
150 included in the analysis.

151 Prescribing rates were calculated using National Records of Scotland (NRS) mid-year
152 population estimates which are based on the 2011 census.²²

153 When comparing data with guidance compliance, Scottish Antimicrobial Prescribing
154 Group (SAPG) policy recommendations for type and dosage of antibiotic were used,²³
155 and for Urinary Tract Infections (UTI), Scottish Intercollegiate Guidelines Network
156 (SIGN) guidelines were applied. UTIs are a common reason for consultation in primary
157 care. National guidelines state that non-pregnant women of all ages with signs and
158 symptoms of acute lower UTI should be treated empirically with trimethoprim or
159 nitrofurantoin for three days.²⁴

160

161 **Results**

162 In 2013 there were 173,664 prescription items for antibiotics, prescribed by nurses in
163 Scotland. This represents 18.6% of all prescribing by independent nurse prescribers.
164 Since 2007, there has been a steady increase in both the rate of antibiotic prescribing
165 and the proportion of antibiotic prescribing in primary care undertaken by nurse
166 prescribers (**Figure 1**). In 2013, prescriptions written by nurses accounted for 4.3% of
167 all primary care antibiotic items.

168 In 2013, 902 nurses prescribed antibiotics on at least one occasion. Although the
169 average number of antibiotic items per nurse was 193 in 2013, the 10% who prescribed
170 antibiotics most frequently accounted for 56.0% of total prescribing by nurses. The 25%

171 most frequent prescribers accounted for 84.5% of total prescribing in the same year. As
172 well as variability between prescribers there was also considerable variability in the rate
173 of prescribing of antibiotics between the 14 NHS boards in Scotland with an 11 fold
174 difference between the NHS board with the highest and the lowest prescribing rate
175 (**Figure 2**). This may reflect differences in the numbers of nurse prescribers and
176 configuration of service delivery within NHS boards across Scotland.

177 Adults, aged from 15 years, accounted for 86.1% of the antibiotic prescriptions written
178 by nurse prescribers in 2013 (**Figure 3**) with 29.6% of prescriptions being for those
179 aged from 60 years of age.

180 Since 2007, in primary care, there has been an increasing trend in nurses prescribing
181 antibiotics that are recommended by the SAPG for first line empirical treatment of
182 infection (amoxicillin, clarithromycin, doxycycline, erythromycin, flucloxacillin,
183 nitrofurantoin, phenoxymethylpenicillin and trimethoprim) (**Figure 4**). In 2013, these
184 first line antibiotics accounted for 92.7% of total antibiotic prescriptions. Moreover,
185 since 2007, there has been a reduction in the proportion of the prescribing of broad
186 spectrum antibiotics (cephalosporins; clindamycin; co-amoxiclav and fluoroquinolones)
187 that are associated with an increased risk of *Clostridium difficile* infection (CDI). By
188 2013 these antibiotics accounted for only 3.9% of total antibiotic nurse prescribing and
189 could be a useful measure of prescribing quality.

190 The number of items prescribed for UTI with a three day duration, as a proportion of
191 total items of trimethoprim, may be another useful measure of prescribing quality. Since
192 2007 there has been an increasing trend in the proportion of total trimethoprim
193 prescriptions in adult females for three day duration (**Figure 5**). In 2013, 71.3% of all
194 prescriptions for trimethoprim in adult females were of three day duration.

195 Amoxicillin is the most commonly prescribed antibiotic by nurses in Scotland
196 accounting for 30.2% of total antibiotic prescriptions in 2013. Evidence based
197 prescribing guidelines implemented in Scotland since 2008 include dosage
198 recommendations for adults. In the case of amoxicillin, the recommended dose in
199 adults is generally 500mg. The proportion of all amoxicillin prescription items for 500mg
200 capsules is a third useful measure of prescribing quality, representing compliance with
201 prescribing guidelines. From 2007 to 2013 there has been an increase from 58.9% to
202 87.2% of amoxicillin 500mg capsules as a proportion of all amoxicillin capsules
203 prescribed by nurses (**Figure 5**).

204

205 **Discussion**

206 Our analysis, which we believe is the first descriptive analysis of nurse antibiotic
207 prescribing at a national level, indicates that the volume of prescribing of antibiotics by
208 nurses has increased since 2007 (both in the number of number of nurses prescribing
209 at least one antibiotic and in the volume of antibiotics prescribed) and is becoming an
210 increasing contributory influence to total antibiotic prescribing in primary care. There is
211 very little other published evidence with which to compare these results. Only three
212 studies were found in the literature which explored the antibiotic prescribing practice of
213 independent nurse prescribers. Nutall et al²⁵ conducted a six month audit of three
214 prescriber-trained nurse practitioners in one primary care setting in the United Kingdom
215 which, like our data, also found that amoxicillin was the most commonly prescribed
216 antibiotic. Of the 1296 antibiotic prescriptions written during this audit, only 200 did not
217 adhere to practice guidelines; however, these were accompanied by clear clinical
218 indication in the medical record. The two other studies found in the literature compared
219 the antibiotic prescribing practice of independent nurse prescribers with General

220 Practitioners (GP) and found no significant differences in patient recovery rates or
221 antibiotic prescription rates between GPs and practice nurses.²⁶⁻²⁷ The latter of these
222 studies was based in the US and so cognisance should be taken with regard to
223 differences in the delivery of healthcare and practitioner education

224 The data indicate that in 2013 only a small percentage of qualified nurse prescribers
225 prescribed any antibiotics and that the 25% most frequent prescribers accounted for
226 84.5% of total antibiotic prescriptions. This is most likely to be due to difference in
227 roles, for example, practice nurses running minor illness clinics may be more likely to
228 see patients with infections requiring antibiotics than health visitors. There is also
229 considerable variability in the rate of antibiotic prescribing across Scottish NHS boards.
230 Again this may be due to differences in nursing roles within each NHS Board. This
231 variation means that a change in prescribing roles, through service delivery, could have
232 an impact on the contribution to primary care antibiotic prescribing made by nurses. For
233 example, an increase in the number of nurses managing minor illness clinics rather
234 than GPs.

235 In the current analysis we cannot make any assessment of the appropriateness of
236 antibiotics prescribed; however, these data indicate improving trends in the prescription
237 of first-line and high-risk antibiotics together with improvements in quality prescribing
238 indicators. The proportion of total antibiotic prescribing by nurses, with first line
239 recommended antibiotics, is higher than observed in all prescribers in primary care and
240 nurses account for a lower proportionate number of higher risk antibiotics.²⁸ The initial
241 priority for SAPG, following its establishment in 2008, was the development of
242 prescribing policies to improve the quality of prescribing of antibiotics through
243 influencing the choice of antibiotic for empirical treatment of infection. These policies
244 were intended to recommend the use of narrower spectrum agents at the expense of
245 those broader spectrum agents which are associated with a higher risk of CDI. From

246 these data it may be possible to suggest that these interventions, aimed at formulary
247 compliance, are having a positive impact on nurse prescribers.

248 This analysis has some limitations. The data on nurse prescribing includes only
249 antibiotics dispensed on NHS GP10N nurse prescription forms and therefore does
250 include any private (non-NHS) nurse prescribing. However, we believe antibiotic
251 prescribing by nurses on a private basis will be very low. The rate of capture of CHI
252 numbers on prescriptions written by nurses was 49.4% and accordingly we cannot be
253 sure if the patterns described are generalisable to all nurse prescribing. Also, the data
254 do not include nurse prescribing in other settings where antibiotics may be prescribed
255 such as out-of-hours and minor illness/injury clinics, as well as within secondary care or
256 in situations where nurses influence medical prescribing or where supplementary
257 prescribing occurs i.e. nurses are in a voluntary partnership with medical staff to
258 prescribe in a patient- specific clinical management plan. Accurate data on the number
259 of nurse independent prescribers, working in the community is, at present, unavailable;
260 however, a current scoping exercise of nonmedical prescribers by The Scottish
261 Government should soon be able to provide this information. This means that it is
262 difficult to draw any conclusions regarding the percentage of qualified prescribers who
263 are currently prescribing antibiotics. The final limitation of this analysis is that we
264 cannot say if the prescribing was appropriate or not. Some studies have been carried
265 out to explore this in greater detail by focussing on the influences on antibiotic
266 prescribing behaviour in nurse prescribers²⁹⁻³⁴ but these were limited by relatively poor
267 response rates, small sample sizes, and designs with no reported underpinning theory.

268

269

270 **Conclusion**

271 In conclusion, nurse prescribing of antibiotics within primary care is increasing each
272 year in Scotland. An analysis of prescribing data in Scotland has shown that this
273 practice varies across the NHS boards and between prescribers but that, on average,
274 antibiotics account for one in every five prescriptions written by a nurse prescriber. The
275 importance of nurse prescribing will only grow and groups working on antimicrobial
276 stewardship interventions must include nurses in their approach or risk losing the ability
277 to influence a large body of antibiotic prescribers. More information is needed to
278 establish if nurse prescribers are prescribing appropriately, although some quality
279 indicators may suggest they are currently following best practice.

280 It has been shown that targeted education interventions can lead to improvements in
281 antibiotic prescribing among general medical prescribers.³⁵ This quantitative data has
282 described nurse antibiotic prescribing patterns in Scotland for the first time but further
283 research, including qualitative data, is also required if we are to establish a better
284 understanding of nurse antibiotic prescribing behaviour and the influences on this
285 behaviour. Only then will there be an ability to target interventions appropriately to
286 improve antibiotic prescribing.

287

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291 **Contributions:** VN, WM & JR wrote the article, GMcG analysed the data and
292 produced the figures

293

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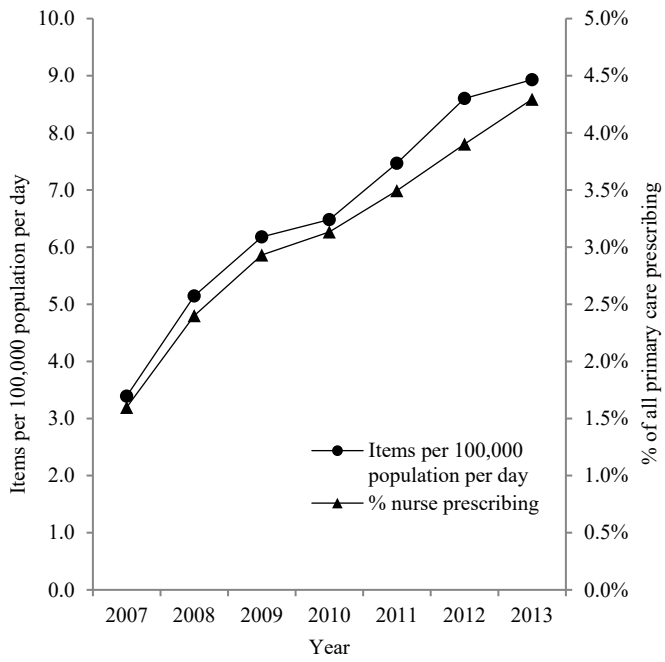
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410 Figure 1. Number of antibiotic items prescribed by nurse prescribers per 100,000 population
411 per day and nurse prescribing as a percentage of all primary care prescribing in Scotland

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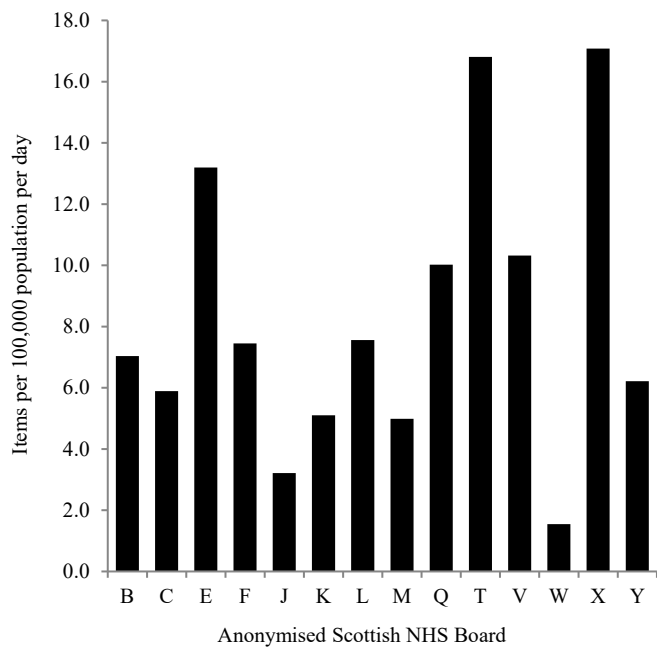
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426 Figure 2. Nurse antibiotic prescribing in 2013 broken down by Scottish NHS Board

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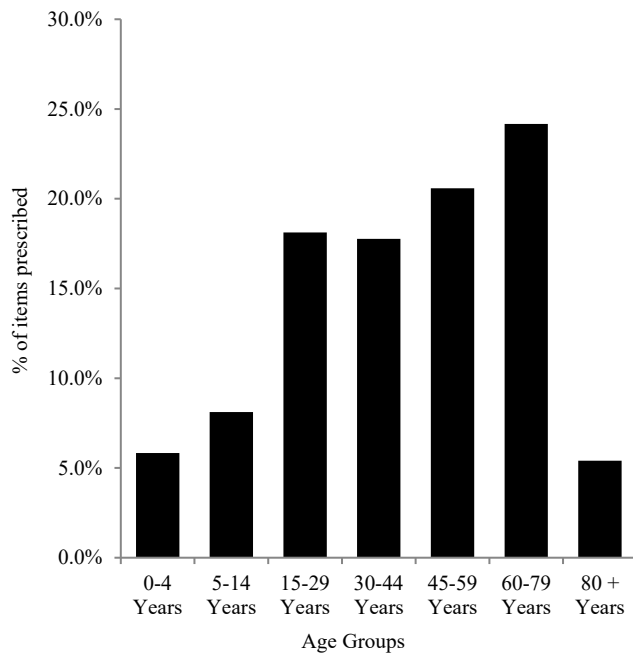
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440 Figure 3. Nurse antibiotic prescribing in 2013 broken down by age group prescribed - CHI
 441 Capture 49.4%

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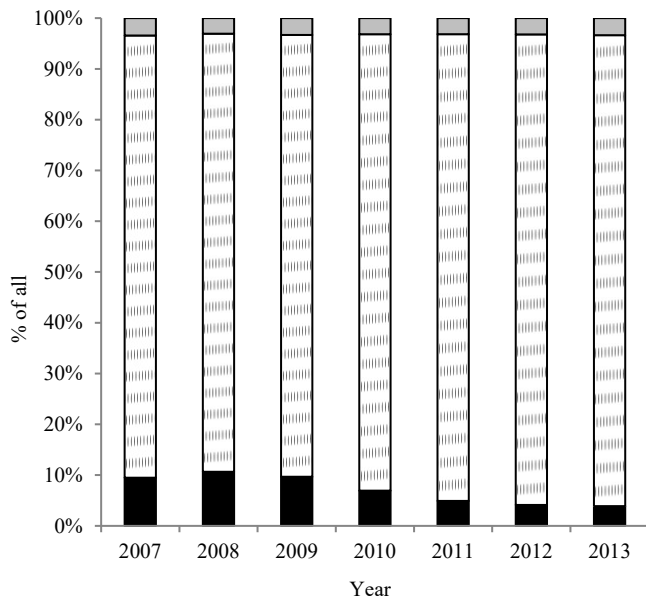
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Other
 Recommended
 Broad Spectrum with Higher Risk of C.diff

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453 Figure 4. Nurse antibiotic prescribing broken down as broad spectrum antibiotics with a higher
 454 risk of *Clostridium difficile*, recommended and other antibiotic categories

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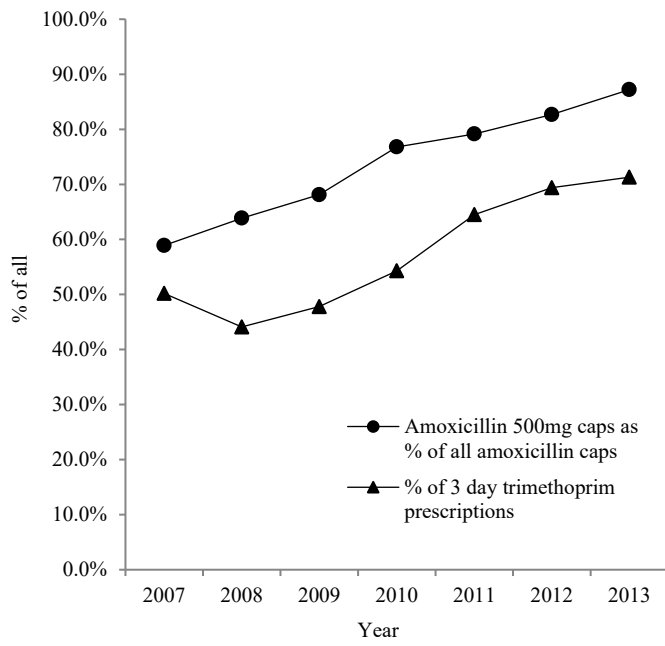
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465 Figure 5. Nurse antibiotic prescribing - Quality measures - amoxicillin 500mg capsules as a
 466 percentage of all amoxicillin capsules and 3 day trimethoprim as a percentage of all
 467 trimethoprim prescriptions for urinary tract infections