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1 **PATTERNS OF DISPENSED NON-MEDICAL PRESCRIBER PRESCRIPTIONS FOR ANTIBIOTICS IN PRIMARY**
2 **CARE ACROSS ENGLAND: A RETROSPECTIVE ANALYSIS**

3

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7

8 Dispensed non-medical prescriber prescriptions for antibiotics in primary care in England.

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17 **STRUCTURED SYNOPSIS**

18 **Objective:** To describe the patterns of dispensed non-medical prescriber prescriptions for antibiotics in
19 primary care across England between 2011 and 2015.

20 **Methods:** A retrospective analysis of dispensed antibiotic prescriptions, written by non-medical
21 prescribers and medical prescribers between 2011 and 2015 in primary care in England, obtained from
22 the National Health Service Business Services Authority.

23 **Results:** Between 2011 and 2015, the numbers of non-medical prescribers (mainly nurses but also
24 pharmacists and small numbers of allied health professionals) in England, who have independent
25 prescribing capability, has risen by over a third to nearly 30,000. Most of these prescribers provide a
26 broad range of services in primary care. The rate of dispensed non-medical prescriber prescriptions for
27 antibiotics over this period has increased, as has the percentage of all primary care antibiotics dispensed
28 that were prescribed by non-medical prescribers, which is currently nearly 8%. The most commonly
29 dispensed NMP antibiotic prescriptions were penicillin, sulfonamides, trimethoprim, macrolides,
30 tetracyclines, and nitrofurantoin.

31 **Conclusion:** Increasing numbers of non-medical prescribers are working in primary care in England and
32 managing infections. Antibiotics prescribed by this group align with surveillance reports of antibiotic use
33 in primary care. With the numbers of non-medical prescribers being set to rise further, they form an
34 important group to involve in antimicrobial stewardship efforts.

35

36

37 INTRODUCTION

38 Over the last decade, legislative authority to prescribe has been extended in a number of countries and
39 is on the policy agenda in many more. ¹⁻³ Appropriately qualified non-medical healthcare professionals
40 (nurses, pharmacists and allied health professionals (AHPs) (hereafter referred to as non-medical
41 prescribers (NMPs)) in a number of countries (including the United Kingdom (UK), the United States,
42 New Zealand, Netherlands, Ireland, Australia, Canada, Sweden), ⁴⁻⁷ have legislative authority to
43 prescribe. Drivers for this role include quicker and more efficient access to medicines, better use of
44 healthcare professionals' knowledge and skills, the need to reduce the workload of doctors and address
45 doctor shortages, and the development of advanced practitioner roles. ⁴

46 As of 2002, changes in legislation enabled any first level registered nurses in the UK, with 3 years
47 qualified experience, to access independent prescribing training typically of 3 to 6-month duration.⁸ This
48 contrasts with some countries (e.g. the United States, Canada and Australia), where training to
49 prescribe, also available to registered nurses, is at master's level and is a component of the advanced
50 nurse practitioner programme, usually 2 years in length.² In 2006, independent prescribing rights in the
51 UK were extended to include registered pharmacists. ⁹ Within the last three years registered AHPs (i.e.
52 physiotherapists, podiatrists/chiropractors, radiographers), ¹⁰ and optometrists ¹¹ have also been
53 provided with independent prescribing rights. Apart from some restrictions around Controlled Drugs by
54 AHPs, NMPs are able to independently prescribe any medicine within their area of competence. The
55 numbers of these prescribers have steadily increased over the last 5 years. There are currently around
56 30,000 nurses, 3000 pharmacists and several hundred AHPs with prescribing capability and these
57 numbers are set to rise. ^{12,13}

58

59 Resistance to antibiotics is a major global health problem ^{14,15} with overuse of antibiotics a key factor.
60 ^{16,17} Although there is significant scope to improve the prescription of antibiotics in primary care, ¹⁸ apart
61 from a retrospective analysis of patterns of primary care antibiotic prescribing by 2414 nurse prescribers

62 in Scotland,¹⁹ which suggested that nurses do follow best practice guideline, there is no evidence
63 available at a national level in England, on the patterns of antibiotic prescribing by NMPs. Given that the
64 majority of NMPs work in primary care in a variety of roles and frequently prescribe antibiotics for
65 infections,^{20,21} it is important that we understand the prescribing behaviour of this group. The aim of
66 this study was to describe the patterns of dispensed NMP prescriptions for antibiotics in primary care
67 across England between 2011 and 2015.

68

69 **MATERIALS AND METHODS**

70 A Freedom of Information (FOI) request was submitted to the National Health Service Business Services
71 Authority (NHSBSA) by MC. The NHSBSA Prescription Service provides prescribing information to
72 prescribers and managing organisations within the National Health Service (NHS) in England. The
73 following information was requested:

- 74 a) the total amount of all antibiotics (British National Formulary (BNF) chapter 5.1) prescribed
75 nationally;
- 76 b) the total amount of all BNF prescribing by NMPs nationally;
- 77 c) monthly dispensing data of all antibiotics (BNF chapter 5.1) written by NMPs at Primary Care
78 level and dispensed in the community for a period of five years from January 2011 to December
79 2015;
- 80 d) the total amount of all antibiotics (BNF chapter 5.1) prescribed at practice level data for four
81 Clinical Commissioning Groups (CCG) (urban CCGs of Central Manchester and Lewisham and
82 rural CCGs of Cumbria and Gloucestershire).

83

84 We sought advice and clarification from the Cardiff University Ethics Committee and the NHSBSA which
85 both confirmed that ethical approval for the study was not required as the data are anonymous and
86 readily available in the public domain from the NHSBSA.

87

88 Prescribing data presented in this paper were derived from FP10 prescription forms written by
89 prescribers in primary care. FP10 prescription forms are NHS prescription forms used by specific groups
90 of prescribers in England, including medical and NMPs and NHS dentists. Data at primary care level
91 contained information on type of NMP and prescription details (name, strength, formulation, quantity
92 and cost of medicine). Data at practice level contained information on type of NMP, total amount of
93 antibiotics prescribed, and practice setting details.

94

95 Descriptive analyses were undertaken, with dispensed prescriptions reported per quarter and
96 standardised using mid-year population estimates (obtained from the Office for National Statistics
97 (ONS)) and number of NMPs (obtained from the Department of Health (DoH)). Results are presented
98 overall, by type of NMP, and by class of antibiotic.

99

100 RESULTS

101 Number of NMPs in primary care across England

102 Between January 2011 and December 2015, the numbers of NMPs rose by 38.5% (absolute increase
103 from 21,545 to 29,836). Most of these prescribers were nurses (88% in 2011 rising to 89.8% in 2015),
104 some were pharmacists (6.9% rising to 9.9%) and a few were AHPs (2.1% rising to 3.3%) (see Figure 1).
105 During this time period, over 98 million prescriptions items dispensed were written by NMPs (Table 1),
106 and the numbers of these prescriptions steadily increased year upon year. There was an 18.1% relative
107 increase in the rate of all dispensed prescriptions items written per 100,000 person days per NMP
108 between 2011 and 2015 (i.e. from 0.0038 in January to March 2011 to 0.0045 in October to December
109 2015).

110

111 Total number of antibiotics dispensed, and dispensed prescriptions written by NMPs

112 The total number of dispensed antibiotic prescriptions, issued by medical and NMPs between 2011 and
113 2015 was over 186 million (Table 1). The rate of all antibiotics dispensed per 100,000 person-days by
114 medical and NMPs decreased from 212.2 in January 2011 to 183.5 in December 2015, with peaks
115 observed during the January to March quarters each year. 6.5% (i.e. over 12 million prescriptions items
116 and representing 12.3% of all NMP prescriptions) (Table 1) of these prescriptions were written by NMPs.
117 The rate per 100,000 person-days per NMP demonstrated a 14.4% relative decrease over this time
118 period.

119 The percentage of all dispensed NMP prescriptions for antibiotics decreased from 14.3% in January to
120 March 2011 to 10.3% in October to December 2015 (a 27.5% relative decrease). This decrease was
121 steady, with peaks observed during the January to March quarter. Conversely, the percentage of all
122 primary care antibiotic dispensed that were prescribed by NMPs steadily increased from 5.6% to 7.6% (a
123 37.1% relative increase). Practice level data identified that the numbers of NMPs working within CCGs

124 varied. As well as working in general practice, these NMPs worked in a variety of settings and provided a
125 broad range of services (including community services, continence service, lymphoedema services,
126 substance misuse services, palliative care, intermediate care, and out-of-hours services) across CCGs.

127 **Dispensed prescriptions for antibiotics written by NMPs**

128 The majority of dispensed NMP prescriptions for antibiotics were written by nurses, and the rate at
129 which they were dispensed, decreased over time from 28.79 at the beginning of 2011 to 26.22 by the
130 end of 2015. Peaks were observed during the January to March quarter. This decrease was also evident
131 in the overall rate of dispensed NMP prescriptions for antibiotics. Dispensed AHP prescriptions for
132 antibiotics did occur, but only infrequently. Dispensed pharmacist's prescriptions for antibiotics
133 increased from 0.83 per prescriber in January 2011 to 4.08 in October 2015. No seasonal trends were
134 observed for pharmacists or AHPs (Table 1).

135 **Types of antibiotics dispensed**

136 Penicillins were the most commonly dispensed antibiotic prescribed by NMPs (see Table 2), although
137 the rate at which these prescriptions were dispensed, decreased over time from 16.4 at the beginning
138 of 2011 to 13.6 at the end of 2015 (a 16.9% relative decrease) (Figure 2). Peaks were observed during
139 January to March quarters. The four next most commonly dispensed NMP antibiotics prescriptions,
140 categorised according to BNF chapter 5.1 anti-bacterial subsections, were sulfonamides and
141 trimethoprim (these were mostly dispensed trimethoprim prescriptions), macrolides, tetracyclines, and
142 nitrofurantoin (which was categorised under the BNF class of “urinary tract infections”) (see Table 2).
143 Trimethoprim dispensing decreased over time by 9.4%, macrolides decreased by 15.3%, whereas
144 tetracyclines increased by 20.8% and nitrofurantoin by 119.4%. Peaks were observed for trimethoprim
145 and nitrofurantoin during the October to December quarter, whereas peaks were observed during the
146 January to March quarter for macrolides and tetracyclines (see Figure 3).

147 **DISCUSSION**

148 Although surveillance data of antibiotic use in England is available²² this data does not differentiate
149 between medical and NMPs. This is the first study to describe the patterns of dispensed NMP
150 prescriptions for antibiotics in primary care across England. Between 2011-2015, the numbers of NMPs
151 in England who have independent prescribing capability has risen by over a third to nearly 30,000. The
152 majority of these prescribers practice in primary care and provide a broad range of services. The rate of
153 dispensed NMP prescriptions for antibiotics over this period has increased, as has the percentage of all
154 primary care antibiotic dispensed that were prescribed by NMPs. The most commonly dispensed NMP
155 antibiotic prescriptions were penicillin, sulfonamide and trimethoprim, macrolide, tetracycline, and
156 nitrofurantoin.

157

158 The findings of this work confirm that NMPs are an increasing contributory influence to total antibiotic
159 prescribing in primary care. This is in-line with national evaluations of NMPs in England in which

160 infections have been identified as a treatment area in which high numbers prescribe medicines, ^{21,23} and
161 for which growing numbers report they intend to do so.²³ Most of these prescriptions were written by
162 nurses. This is unsurprising given that greater numbers of nurses (the largest NHS workforce in England
163 ²⁴), as compared to pharmacists and AHPs, are qualified to prescribe. Furthermore, nurses were the first
164 group of non-medical healthcare professionals to be granted prescribing rights,⁸ and have been
165 prescribing antibiotics independently in primary care for over 15 years.²⁵ Given how health services are
166 set to change, ^{12,13}and the key roles nurses will play within these services, ^{12,13} these numbers will only
167 increase.

168

169

170 Our findings align with a retrospective analysis of patterns of primary care antibiotic prescribing by
171 nurse prescribers in Scotland which indicated an increase in the volume of antibiotic prescribing by
172 nurses.¹⁹ In-line with findings of national research, ^{21,23, 26} practice level data suggest that non-medical
173 prescribing has been implemented inconsistently across CCGs, and NMPs work in a broad range of
174 services and roles and prescribe antibiotics. This may account for the differing rates of antibiotic
175 prescribing by NMPs that have been reported previously.¹⁹ Recognising which settings and services
176 these relatively new groups of prescriber's work is important if we are to provide them with appropriate
177 support in their choice and use of antibiotics, and optimise prescribing practice.

178

179 In-line with guidance for the treatment of minor infections, ²⁷ narrow spectrum antibiotics (penicillins,
180 macrolides, tetracyclines) were the most frequently dispensed NMP prescriptions for antibiotics.
181 Although not reporting specifically on NMPs, this has also been observed in surveillance reports of
182 antibiotic use in primary care²² and aligns with findings of nurse prescribers in Scotland.

183

184 Our data does not enable us to make any judgement on the appropriateness of prescribing by NMPs
185 and more information is required to establish whether these prescribers are prescribing appropriately.

186 However, the overall decrease in rate of dispensed NMP prescriptions for antibiotics, the most
187 frequently prescribed antibiotics being narrow spectrum with small numbers of dispensed NMP
188 prescriptions for broad spectrum antibiotics (recommended when antibiotics are necessary, but
189 reserved to treat resistant disease²⁷), suggests that these prescribers are following government
190 recommendations for self-limiting minor infections. The rise in dispensed NMP prescriptions for
191 nitrofurantoin might be explained by national infection guidelines from 2014 recommending its use in
192 the treatment of community urinary tract infections (UTI). Given the rising numbers of NMPs and their
193 increasing contributory influence to total antibiotic prescribing in primary care, it is important that this
194 group are involved in antimicrobial stewardship activities.

195

196 Much existing research has focused upon trying to understand why general practitioners (GPs) prescribe
197 antibiotics for RTIs however, if we are to design interventions to target the prescribing behaviour of the
198 growing numbers of NMPs, further research is required to establish a better understanding of the
199 influences on the prescribing behaviour of these prescribers including similarities and differences in
200 experiences, challenges and management strategies.

201

202 Study Limitations

203 The data analysed only included data for NMP prescriptions dispensed i.e. prescriptions written (but not
204 dispensed) were not included. Therefore, our findings may not reflect the prescribing patterns of NMPs.

205 We were only able to access practice level data from four CCGs and so the range of services provided by
206 these prescribers may not be representative of all CCGs in England. However, these services are in-line
207 with national evidence.^{21,23,26} Although our data does tell us the percentage of NMPs prescribing
208 antibiotics, we were unable to determine whether prescribing was appropriate. The data only includes
209 antibiotics prescribed on FP10 prescriptions by NMPs. We do not know if NMPs prescribed antibiotics

210 on other types of NHS or private prescriptions. However, current evidence suggests that the numbers of
211 private prescriptions written by NMPs are low.^{20,23}

212

213 **CONCLUSION**

214 Increasing numbers of NMPs are working in primary care in England and managing infections.
215 Antibiotics prescribed by this group aligns with surveillance reports of antibiotic use in primary care.
216 With the numbers of NMPs being set to rise further, they form an important group to involve in
217 antimicrobial stewardship efforts.

218

219 **FUNDING**

220 This study was carried out as part of our routine work.

221 **TRANSPARENCY DECLARATIONS**

222 Competing interests: All authors have completed the ICMJE uniform disclosure form at
223 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted
224 work, no financial relationships with any organisations that might have an interest in the submitted
225 work in the previous three years, no other relationships or activities that could appear to have
226 influenced the submitted work.

227 **CONTRIBUTORSHIP STATEMENT**

228 MC made a substantial contribution to the conception and design of the work; the acquisition and
229 interpretation of data, and drafting of the work. DG made a substantial contribution to the design of the
230 work, the analysis and interpretation of data, and drafting of the work. RL made a substantial
231 contribution to the design of the work, the interpretation of data, and critically revised drafts of the
232 work. All authors approved the final version to be published and agree to be accountable for all aspects

233 of the work in ensuring that questions related to the accuracy or integrity of any part of the work are
234 appropriately investigated and resolved.

235

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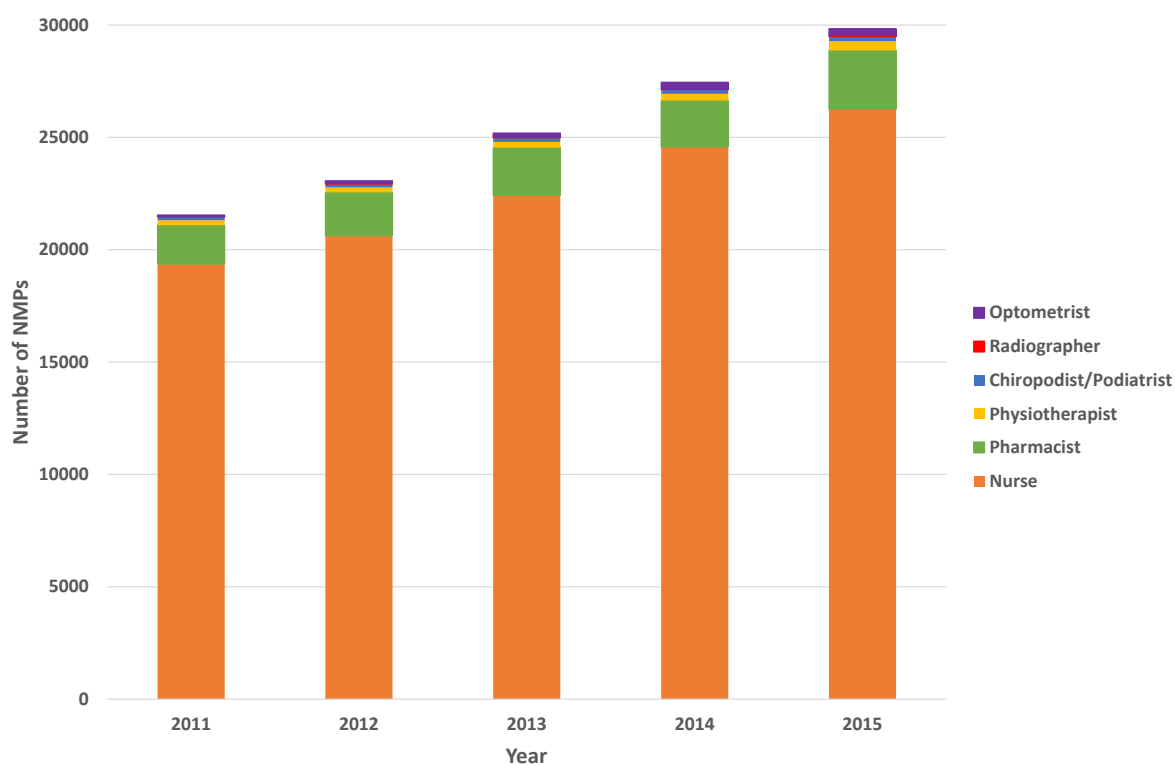
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312 Table 1: *NMP prescriptions dispensed in primary care in England between January 2011 and December*
 313 *2015*

NMP type	Total number of NMP prescriptions dispensed in primary care	Total number of NMP antibiotic prescriptions dispensed in primary care	Total number of dispensed antibiotic prescriptions in primary care	% of all NMP dispensed prescriptions for antibiotics	% of all dispensed antibiotics prescribed by NMPs
Overall	98,577,980	12,143,695	186,323,947	12.3	6.52
Nurse	93,102,682	12,077,107		13.0	6.48
Pharmacist	5,454,942	66,332		1.2	0.04
Optometrist	3,846	29		0.8	0.00
Physiotherapist	2,380	141		5.9	0.00
Radiographer	0	0		0.0	0.00
Chiropodist	14,130	86		0.6	0.00

314

315 Figure 1: *Year-by-year number and type of NMPs in England*



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322 Table 2: Antibiotic class and type per NMP

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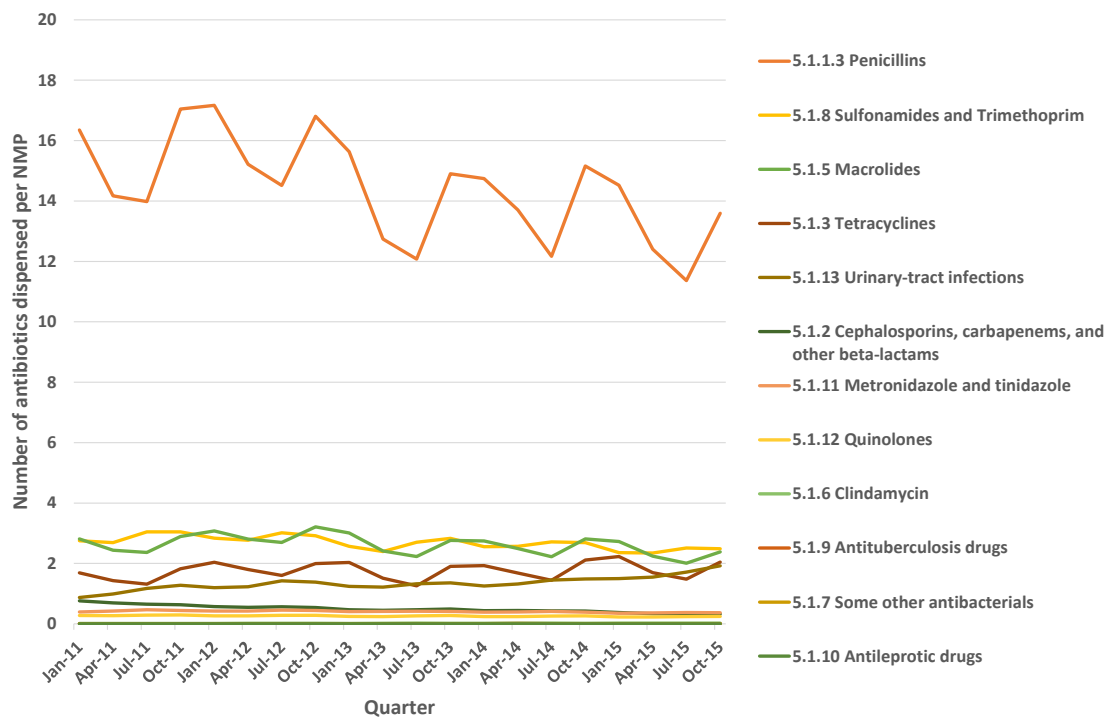
Antibacterial class	NMP type			
	Nurse	Pharmacist	Physiotherapist	Optometrist
Penicillins	7,243,002	27,042	86	5
Sulfonamides and trimethoprim	1,349,594	8,733	1	0
Macrolides	1,313,933	8,211	11	5
Tetracyclines	883,060	11,590	13	19
Urinary-tract infections (nitrofurantoin)	688,924	5,129	5	0

324

325

326 Figure 2: Dispensed NMP prescriptions for antibiotics, per NMP by BNF class (all classes)

327



328

329

330 Figure 3: Rate of dispensed NMP prescriptions for antibiotics, per NMP by BNF class
 331 (sulfonamides and trimethoprim, macrolides, tetracyclines, nitrofurantoin, cephalosporins,
 332 carbapenems, and other beta-lactams, metronidazole and tinidazole, and quinolones).

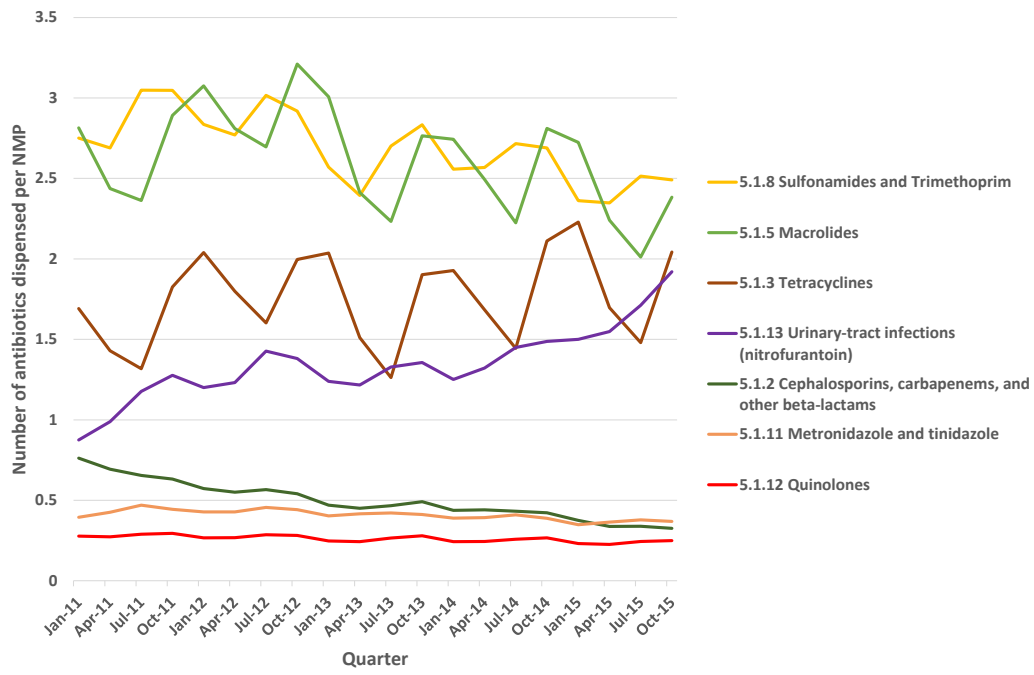
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340 This figure appears in colour of the on-line version of *JAC* and in black and white in the printed version of *JAC*