

Towards transforming community eye care: an observational study and time-series analysis of optometrists' prescribing for eye disorders

Jonuscheit, S.; Geue, C.; Laidlaw, R.; Fischbacher, C.; Melia, B.; Lewsey, J.; King, C.

Published in:
Public Health

DOI:
[10.1016/j.puhe.2021.04.029](https://doi.org/10.1016/j.puhe.2021.04.029)

Publication date:
2021

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in ResearchOnline](#)

Citation for published version (Harvard):

Jonuscheit, S, Geue, C, Laidlaw, R, Fischbacher, C, Melia, B, Lewsey, J & King, C 2021, 'Towards transforming community eye care: an observational study and time-series analysis of optometrists' prescribing for eye disorders', *Public Health*, vol. 196, pp. 107-113. <https://doi.org/10.1016/j.puhe.2021.04.029>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please view our takedown policy at <https://edshare.gcu.ac.uk/id/eprint/5179> for details of how to contact us.



Original Research

Towards transforming community eye care: an observational study and time-series analysis of optometrists' prescribing for eye disorders

S. Jonuscheit^{a,*}, C. Geue^b, R. Laidlaw^a, C. Fischbacher^c, B. Melia^c, J. Lewsey^b, C. King^a^a School of Health and Life Sciences, Glasgow Caledonian University, Cowcaddens Road, Glasgow, G4 0BA, UK^b Health Economics and Health Technology Assessment, University of Glasgow, Glasgow, G12 8RZ, UK^c Information Services Division, Public Health Scotland, Edinburgh, UK

ARTICLE INFO

Article history:

Received 13 August 2020

Received in revised form

29 March 2021

Accepted 30 April 2021

Keywords:

Community eye care

General practice workload

Non-medical prescribing

Optometry

ABSTRACT

Objectives: This study aimed to provide evidence on the therapeutic prescribing activity by community optometrists in Scotland and to determine its impact on workload in general practice and ophthalmology clinics.

Study design: Scottish administrative healthcare data for a 53-month period (November 2013–April 2018) were used to analyse non-medical prescribing practice by optometrists.

Methods: Using interrupted time-series regression (Autoregressive Integrated Moving Average), we assessed the impact of optometrist prescribing on ophthalmology outpatient attendances and general practice prescribing for eye disorders.

Results: A total of 54,246 items were prescribed by 205 optometrists over the study period. Since the commencement of data recording, optometrist prescribing activity increased steadily from a baseline of zero to 1.2% of all ophthalmic items prescribed. Neither the monthly number of items prescribed nor the size of optometric workforce were associated with a reduction in ophthalmology outpatient appointments over time.

Conclusions: Optometrists increasingly contribute to community ophthalmic prescribing in Scotland, releasing capacity and lessening general practice, but not secondary care workload. There appears to be an underutilisation of optometrists related to the management of dry eye, which represents an opportunity to release further capacity.

© 2021 The Authors. Published by Elsevier Ltd on behalf of The Royal Society for Public Health. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Population growth, increasing life expectancy and a shift of illness patterns from acute to long-term conditions and multimorbidity is increasing demand for health and eye care services globally.^{1–4} Recent global estimates indicate that health systems and eye care providers in particular will face significant challenges related to an increasing prevalence of visual impairment, with the number of blind people projected to be 38.5 million by 2020 and 115 million worldwide by 2050.³ In order to mitigate the anticipated rise in visual impairment, the WHO has developed a global action plan for universal eye care⁵ that includes recommendations

relating to more closely integrated eye care services to ensure comprehensive care.⁶ In the UK, a considerable rise in sight-threatening conditions such as glaucoma (49%), cataract (52%) and neovascular age-related macular degeneration (64%) have been predicted by the year 2035.⁷ Non-sight-threatening conditions such as dry eye are also common among the older populations.⁸ Short-term initiatives such as waiting time reduction programmes are unlikely to be sufficient to resolve long-term increases in demand.⁷

To respond to the increasing demand for eye care and improved timeliness and patient access to medicines, some countries such as the UK have developed strategies to shift certain types of clinical care from hospital to community settings.^{9,10} This includes the introduction of non-medical prescribers (NMPs) to healthcare systems, where autonomous prescribing authority is delegated to non-medical professionals such as nurses, pharmacists and optometrists.^{11,12} Following a government-commissioned review of prescribing,¹³ independent prescribing authority was extended to UK optometrists in 2008, with the specialist prescriber register

* Corresponding author. Department of Vision Sciences, Glasgow Caledonian University, Cowcaddens Road, Glasgow, G4 0BA, United Kingdom. Tel.: +44 (0) 141 331 3059 (mobile).

E-mail address: Sven.Jonuscheit@gcu.ac.uk (S. Jonuscheit).

launched in 2009. Until then, people experiencing eye problems that required care were managed by their general practice or in secondary care, but the new framework allowed optometrists to autonomously manage eye conditions in the community.¹⁴ In order to qualify as optometrist independent prescriber (OIP), optometrists are required to have a minimum of two years clinical work experience, to undertake three postgraduate modules in therapeutic prescribing, to complete 24 clinical hospital sessions under the supervision of an ophthalmologist and to pass a common computer-based assessment.¹⁵

Evidence from other clinical areas suggests that NMPs in nursing and pharmacy provide services that result in more timely and efficient care.^{16,17} A recent Cochrane review suggested that NMPs can deliver comparable patient outcomes such as in the clinical management of hypertension, hypercholesterolaemia, diabetes and medication adherence as well as improved patient satisfaction and quality of life. No studies on optometrist NMP practice were identified as part of this review,¹⁸ but scope of practice patterns of NMP by optometrists have been assessed in studies from Australia,¹⁹ Canada²⁰ and New Zealand.²¹ While general practice faces an increase in demand for primary care, leading to higher workloads (overburden), NMP practice has the potential to address the burden on stretched services, to increase overall capacity and efficiency of community health care and to reduce primary care workload, as has been shown for pharmacist NMPs.¹⁶

Evidence of the impact of NMPs related to other professions (e.g. pharmacy) is becoming more readily available,^{22,23} but despite the introduction of OIP a decade ago, there is considerable uncertainty relating to the range of prescribing activity and the clinical and economic impact of OIP practice.¹⁸ Given that both general practices and ophthalmology clinics in secondary care are experiencing continuous increases in demand for eye care services, it would be timely and beneficial to ascertain the impact of OIP practice. This study was designed to provide evidence on community OIP practice in Scotland between 2013 and 2018, i.e. for a period unaffected by the COVID-19 pandemic, and to determine its impact on i) general practice eye care-related workload and ii) ophthalmology outpatient workload using Scottish administrative healthcare data.

Methods

Optometrist prescribing data

Anonymised data were provided by the Information Services Division (ISD) of NHS National Services Scotland²⁴ (now part of Public Health Scotland) for the period of November 2013 to April 2018 on all items prescribed by optometrists holding an independent prescriber qualification. Prescribing data were available by month and by OIP practitioner working in NHS Health Boards in Scotland.^a Individual level data were aggregated to represent the number of items reimbursed per health board and per calendar month. Data from optometrists who were not qualified independent prescribers were not included in this administrative dataset and are therefore not available for analysis.

General practice prescribing data

General practice prescribing data were obtained from ISD for the period October 2015 to April 2018 for all general practices in

Scotland and were used to calculate the combined total of all OIP and general practice prescribing for eye conditions. Owing to the shorter time period for which general practice data were available, comparison with OIP was made only for this period (October 2015 to April 2018).

Ophthalmology outpatient data

Data on routine monthly attendance at ophthalmology outpatient clinics were obtained for all NHS Health Boards in Scotland from ISD for the period of November 2013 to April 2018. Data were reported as being 98%–99% complete.²⁵ Information from NHS Orkney, NHS Shetland and NHS Western Isles were excluded to ensure comparability with OIP data.

Types of medicines analysed

The analysis focussed specifically on OIP and general practice prescribing activity relevant to eye care and was limited to eye-related medicines specified in section 11 of the British National Formulary (BNF) and eye products listed in BNF (pseudo) section 21.²⁶

Sub-group analysis and exclusion

We carried out a sub-group analysis to assess prescribing patterns for ocular preparations of antibacterials, anti-inflammatories and dry eye treatments. Prescriptions relating to items which were clearly unrelated to ocular disease were excluded from the analysis (0.6% of all items).

Statistical analysis

Descriptive statistics were generated for prescribing activity of OIPs over time and by NHS Health Board area. OIP prescribing activity was measured as the percentage of all eye-related prescribing (total number of items prescribed by OIP and general practice). Attendance rates at ophthalmology outpatient clinics are presented per 100,000 population.

We used interrupted time-series regression with Autoregressive Integrated Moving Average (ARIMA) errors to assess the impact of two independent variables: i) the number of items prescribed by OIPs and ii) the number of active OIP practitioners on the number of patients seen at ophthalmology outpatient clinics in NHS Scotland over a 53-month period. The analytic strategy consisted of initially modelling the ophthalmology outpatient clinic attendance data time-series to obtain an adequate preliminary model and then testing the effect of the two independent variables. Several models were developed, and the most parsimonious model was selected using the Akaike Information Criterion. The effect of OIP prescribing activity (number of items prescribed per month) and the number of active OIPs at each month were tested separately using the best fitting model. The analysis was carried out using the Stata SE v15 software package (Stata Corp, College Station, TX).

Ethics statement

As data were non-identifiable administrative prescribing data, ethical approval was not required.

Patient and public involvement

The data used were national administrative healthcare data, and patients were not involved in this study.

^a Data were not available for two health boards, NHS Orkney and NHS Shetland, as there was no recorded non-medical OIP prescribing activity over the study period. Data from one health board, NHS Western Isles, were excluded from the analysis because of small numbers and to comply with data protection legislation.

Results

Regional distribution of OIPs

A total of 205 OIP practitioners were prescribing in Scotland during the study period. Fig. 1 shows the number of OIP practitioners, calculated per 100,000 population for each local health board. The number of practitioners increased year-on-year, particularly in larger health boards such as NHS Ayrshire and Arran, NHS Grampian and NHS Greater Glasgow and Clyde (Fig. 1).

Quantity of prescribed items, temporal and regional variability

Over the 53-month period, a total of 54,246 items were prescribed by OIPs. A consistent trend of increasing prescribing activity with some seasonal dips was observed (Fig. 2).

Fig. S1 A and S1 B (supplementary files) contrast the trends in the number of prescribed items over time between an urban setting (NHS Greater Glasgow and Clyde) and a rural setting (NHS Highland). The annual prescribed items and the relative differences for all full calendar years are shown by health board (Supplementary Tables 1 and 2, respectively). Overall, prescribing activity increased across Scotland for each full year reported. Looking at the most recent year-to-year differences (2016–2017), there was a relative increase in items prescribed, ranging from +7% in NHS Fife to +160% in NHS Borders. A reduction in prescribing activity was observed for a single health board (NHS Forth Valley: –79%).

Comparison of OIP and general practice prescribing for eye disorders

Using the latest monthly data available (April 2018), the 205 OIPs issued approximately 1.2% of all eye-related prescriptions issued by OIPs and general practices combined, with general practice prescriptions originating from 1072 practices. Both the magnitude and the proportion of prescribing carried out by OIPs were

relatively low when compared to the volume of prescribing in general practice. However, we observed a steady increase in OIP prescriptions from a baseline of zero, alongside a corresponding decrease in ophthalmic items prescribed in general practice. Between October 2015 and April 2018, OIPs represented approximately 3% of the combined number of general practice and OIP prescribers in Scotland and prescribed 1.2% of all antibacterial items, 2.4% of all anti-inflammatory items and 0.4% of dry eye items. To illustrate the trend in OIP prescribing activity over time, the left-hand side panel of Fig. 3 shows the number of items prescribed by OIPs across Scotland. Timelines are presented in Fig. 3 for anti-bacterials (Fig. 3A), anti-inflammatories (Fig. 3B) and dry eye treatments (Fig. 3C), indicating an increase in OIP prescribing activity. In contrast, a modest, albeit variable, reduction in the number of items prescribed in general practice for the same groups of items is observed in the right-hand side panel of Fig. 3A–C.

Impact of OIP practice on ophthalmology outpatient clinics: ARIMA time-series analysis

Fig. 4 shows attendance rates at outpatient ophthalmology clinics from November 2013 to April 2018 for each NHS Health Board. The figure serves two purposes. It allows for i) a time-related comparison of normalised outpatient appointments and ii) an appraisal of regional outpatient activity. Comparing year-on-year patterns, we observed a variable pattern of outpatient activity across Scotland, with a steady decrease of outpatient attendances in some areas (e.g. NHS Grampian, NHS Borders and NHS Lanarkshire). The focus of this analysis is on the five full calendar years of data (2013–2017; indicated by 2013-navy; 2014-burgundy; 2015-green; 2016-orange; 2017-mint). Data for 2018 (red) represent incomplete data because of lack of data availability but are shown to allow for the normalised regional comparisons between health board areas per 100,000 population. This comparison is still valid as the cutoff point was identical across all health board areas.

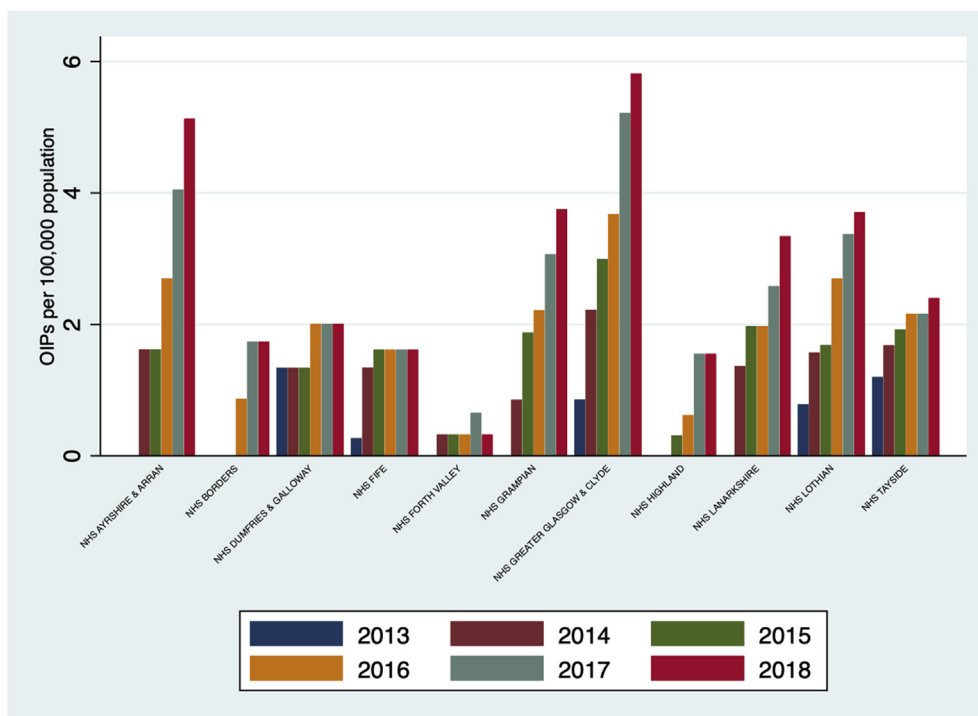


Fig. 1. OIP workforce numbers per 100,000 population by NHS Health Board over time. OIP, optometrist independent prescriber.

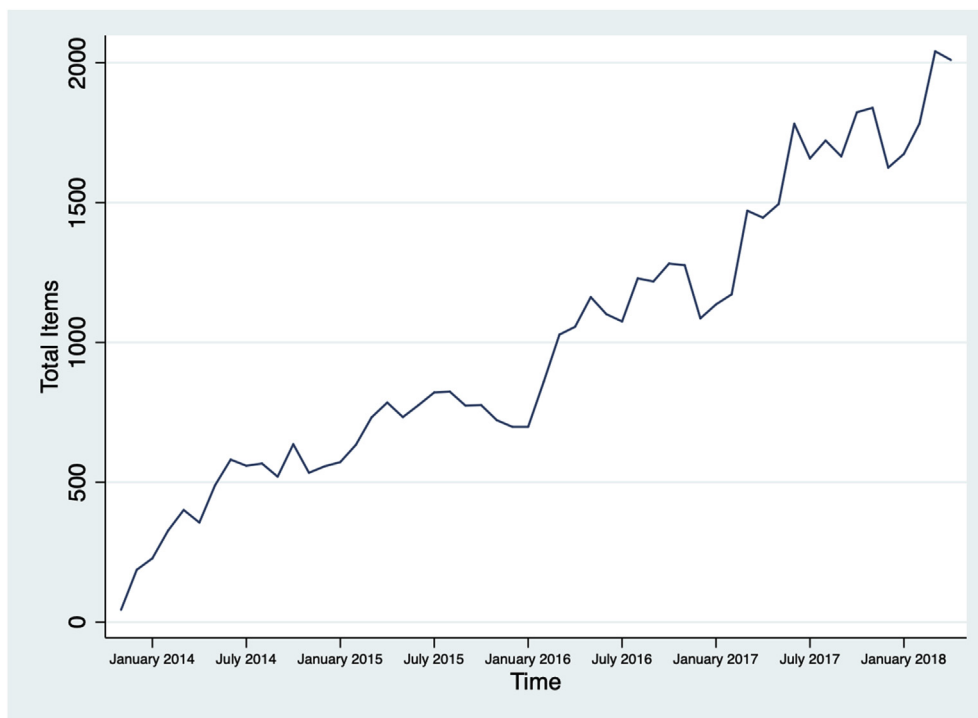


Fig. 2. Monthly items prescribed by OIP practitioners, Scotland, 2014–18. OIP, optometrist independent prescriber.

Time-series analyses were undertaken for the whole of Scotland. The final fitted model was an ARIMA with one regular autoregressive term and first order differencing, with 53 observations (months). The analysis for the association of ophthalmology outpatient appointments and the number of items prescribed by OIPs per month found a small but clinically irrelevant increase in ophthalmology outpatient appointments over time (0.08%; confidence interval [CI], 0.03%–0.14%; $P = 0.004$; Table 1). Similarly, the size of the OIP workforce was not associated with a reduction in ophthalmology outpatient appointments, with both the point estimate of the effect size and bounds of the CI excluding a negative association (1.0%; 95% CI, 0.34–1.86%; $P = 0.004$). With the slight 1.0% increase in outpatient attendances, it is, at present, not likely that OIP practice is causally related to any change in hospital workload. However, analyses by Optometry Scotland show that the increase in hospital appointments has increased at a lower rate in Scotland than in England (unpublished data), and OIP practice may have contributed to this lower rate of increase.

Discussion

Main findings of the study

This study provides, for the first time, a quantitative time-series analysis of optometrist prescribing in Scotland in relation to general practice and outpatient activity using NHS administrative data. Non-medical prescribing capacity in Scottish community eye care has increased steadily since data recording began in 2013 and continues to develop. Our findings suggest positive effects of OIP practice, e.g. optometrists contributing to lessening the burden in primary care, and a modest reduction in general practice prescribing for eye disorders. This observation suggests a release of capacity and

therefore a positive impact on workload in general practice. The outcomes of our study suggest that, rather than contributing to a shift of eye care from secondary to primary care, there is a (slow) shift occurring within primary care, i.e. from general medical practice to optometric practice. Given the demand and workload challenges in general practice, such a shift is desirable and has the potential to release additional general practice capacity in the long term.

What is already known on the topic

OIP has been introduced in a number of countries, including Australia, Canada, New Zealand and the USA.^{19–21,27} In Australia, a scope of practice survey indicated that just under half of responding optometrists were licensed to prescribe medicines in the community. The most commonly prescribed groups of drugs included dry eye treatment, decongestants and antiallergic medications, but there were low rates of prescriptions for anti-infectives.¹⁹ Since 2011, community optometrists in Ontario, Canada, have been managing patients before referral to hospital eye services, with 6% of referred patients being on a prescription medication issued by optometrists. As in the UK, there are few restrictions regarding the clinical circumstances under which optometrists are allowed to prescribe for ocular disorders.²⁰ In New Zealand, which is comparable to Scotland in geographic diversity, population figures and the publicly funded healthcare system, non-medical prescribing has also been implemented. Most optometrists in New Zealand practice in the community, but an overarching NMP policy that allows for safe and sustainable delivery of NMP services was recently still to be developed (2017).²¹ In the UK, OIP training takes place at the postgraduate level, whereas optometrists in New Zealand gain prescribing authority as part of their undergraduate training/prequalification training, and 66% of all optometrists are optometrist prescribers.²¹

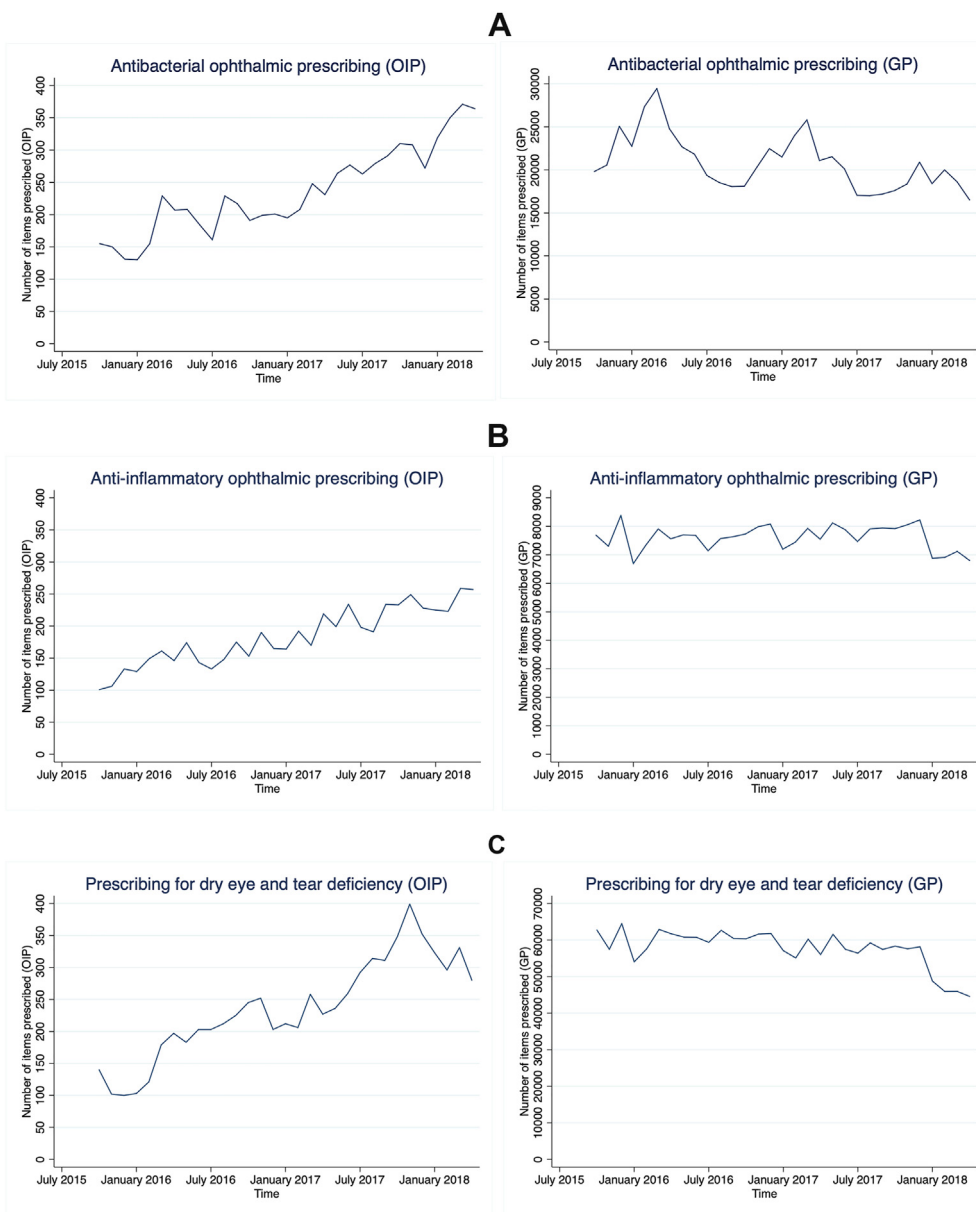


Fig. 3. A. Antibacterial ophthalmic prescribing (number of items) by OIPs (left) vs general practice (right). B. Anti-inflammatory ophthalmic prescribing by OIPs (left) vs general practice (right). C. Prescribing for dry eye and tear deficiency by OIPs (left) vs general practice (right). GP, general practice; OIP, optometrist independent prescriber.

Underutilisation of optometrists in the treatment of dry eye and transfer of care

One group of ophthalmic items commonly prescribed in general practice were dry eye related. While the overall proportion of items prescribed by optometrists is gradually increasing, there appears to be underutilisation of community optometrists in the management of dry eye. Even though a proportion of patients with dry eye will obtain lubricants classified for pharmacy sales without the need for a prescription, a further reduction in dry eye-related workload in general practice would release additional capacity and could be achieved by transferring the care of patients with dry eye to community optometry. Optometrists are well placed to manage these patients, allowing general practices to dedicate consultation time to patients with more severe conditions. However, many patients will be attending general practice for non-ocular morbidity and mention dry eye as one of several concerns, thus allowing general practitioners (GPs) to prescribe dry eye treatments alongside any systemic medication that may be required.

A transfer of care within primary care is already under way, partly facilitated by the new (2006) ophthalmic contract in Scotland^{28,29} and partly through locally organised enhanced eye care schemes in which accredited optometrists may prescribe/supply without being qualified NMPs. Notwithstanding, a larger scale transfer of care would require careful impact analysis, which is beyond the scope of the present article. Factors that would need to be considered include economic aspects and viability for general practice, patient access and structural factors such as the capacity of OIPs to issue repeat prescriptions. However, if primary care, optometry, commissioners and policy-makers agree that such change continues to be desirable, the patient-centred service and pathway changes will require time to reach maturity.

In contrast to the observed effect of OIP on general practice, we did not find robust evidence that the number of items prescribed or the number of active OIP practitioners had a measurable effect on the number of ophthalmology outpatient

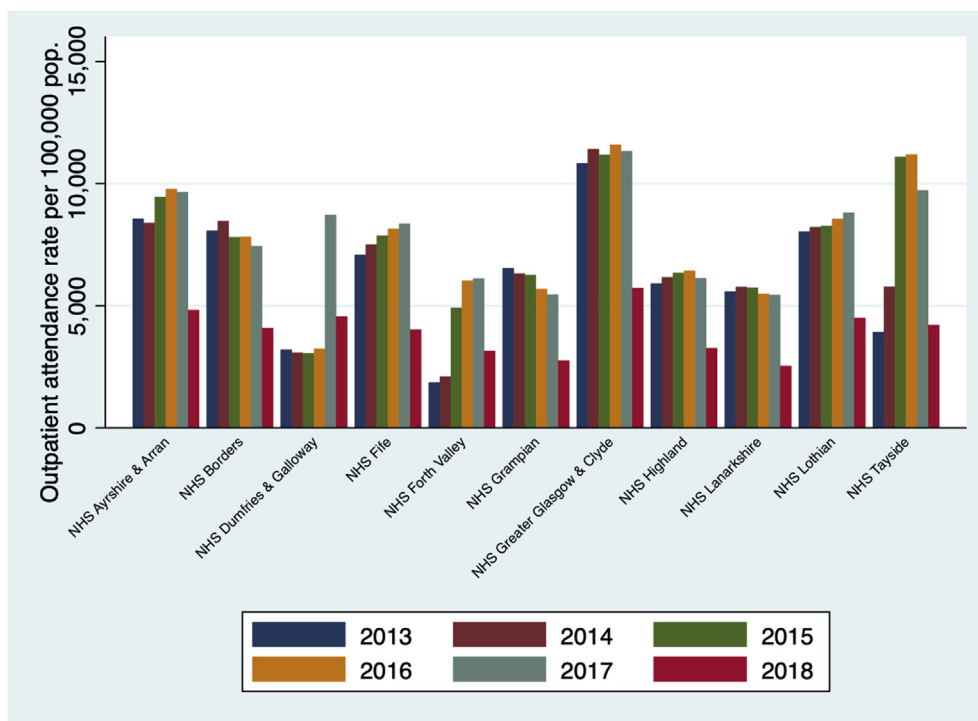


Fig. 4. Attendance rate at outpatient ophthalmology clinics per 100,000 population by NHS Board.

Table 1

Outcome of ARIMA model for two independent variables: i) number of items prescribed and ii) number of OIPs. Akaike Information Criterion

ARIMA model	Estimated effect (%)	95% CI	P value	AIC	Adjusted R ²
Number of prescribed items	0.08	0.03 to 0.14	0.004	-44.54	0.67
Number of OIPs	1.00	0.34 to 1.86	0.004	-38.29	0.64

AIC, Akaike Information Criterion; CI, confidence interval; OIP, optometrist independent prescriber.

appointments. This may change in the future when community optometrists become more involved in the management of patients with potentially sight-threatening ocular disease such as glaucoma.

Aspects related to demand for OIP in the UK

As in general practice, increasing demand on ophthalmology outpatient services suggests that changes in the organisation of care are required. The introduction of NMP for optometrists reflects not only a response to the need for a change to eye care service delivery but also the need to respond to demographic and workforce changes such as longer life expectancy and the fact that substantial proportions of healthcare workers, including GPs and ophthalmologists, are reaching retirement age. At hospitals across the UK, ophthalmology services accounted for nearly 10% of all secondary care outpatient appointments and for approximately 6% of surgical procedures.³⁰

This study suggests that OIP practice has positive effects in that it can release capacity in primary care ophthalmic prescribing. However, even though there has been a consistent increase in activity, the magnitude of OIP practice is still comparatively low when viewed against the volume of general practice ophthalmic prescribing. For this reason, the time-series analysis for the effect of OIP prescribing on general practice prescribing should be repeated in five years' time, when the OIP activity has matured further and prescription rates have increased. Equally, analyses relating to the

quality and formulary adherence of OIP practice are needed to ascertain the quality of OIP services.

In the future, further insight into OIP activity and its impact could be gained by validating centralised prescribing data using regional or localised prescribing audits or research studies. Ideally, such smaller scale studies would also consider longitudinal aspects such as OIP workforce trends and the demand for OIP practice.

Study limitations

Our study was limited by the availability of general practice prescribing data (2015 onwards). A further limitation was the unavailability of diagnostic patient-level data, which prevented us from ascertaining with confidence whether disease-specific prescribing recommendations were followed. ARIMA modelling was also attempted using general practice prescribing as the dependent variable. However, the magnitude of OIP prescribing was too small relative to that of general practice prescribing.

Conclusions

OIP practice is making a steadily increasing contribution to eye-related prescribing in Scotland, potentially reducing workload of general practices. Greater utilisation of OIPs for the management of some ocular conditions has the potential to further alleviate demand on general practice. There is limited evidence of an

association between OIP practice and hospital outpatient activity. However, this is not unexpected, as subject experts and policy-makers have confirmed. In order to assess the quality of OIP practice, patient-level information should be included in prescribing data sets, and the economic impact of OIP practice, which is currently unknown, should be carefully assessed.

Author statements

Ethical approval

Not required due to administrative, secondary health data being used.

Funding

This study was supported through a Catalytic Research Grant of the Scottish Government Chief Scientist Office (CGA/17/52). The funder had no role in study design or analysis.

Competing interests

The authors have no competing interests.

In the interest of transparency, the authors wish to note that the employing institution of the corresponding author is a provider of OIP training modules. Many students undertaking these modules receive or have received funding for their training from NHS Education for Scotland.

Authors' contribution

S.J., C.G., C.F., J.L., C.K. and B.M. conceived and planned the study. C.F. and B.M. advised on prescribing practice of optometrists and general practitioners and facilitated data access. R.L. and C.G. conducted the statistical analysis. S.J., C.G. and R.L. drafted the manuscript. All authors commented on the manuscript and approved the final version.

Data sharing statement

Prescribing data for optometrists can be obtained from ISD, NHS Health Scotland, through application and payment of a fee to cover analysts time for data extraction.

Acknowledgments

We dedicate this paper to our colleague Dr Becky Laidlaw, who passed away in 2019. Part of this work was presented at the Health Services Research UK conference in Manchester, 2–3 July 2019. The authors thank Michael Doughty, Gunter Loffler, Nick Mays, Frank Munro, Barnaby Reeves, Ellen Schafheutle and Niall Strang for insightful discussions. The authors are also grateful for the feedback of the Directorate of Population Health at the Scottish Government, especially Janet Pooley, Mike Stewart and Jacqueline Dougall.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2021.04.029>.

References

1. Tham Y-C, Li X, Wong TY, et al. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology* 2014;**121**:2081–90.
2. GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016;**388**:1545–602.
3. Bourne RRA, Flaxman SR, Braithwaite T, et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. *Lancet Glob Heal* 2017;**5**:e888–97.
4. Kingston A, Comas-Herrera A, Jagger C, et al. Forecasting the care needs of the older population in England over the next 20 years: estimates from the Population Ageing and Care Simulation (PACSim) modelling study. *Lancet Publ Health* 2018;**3**:e447–55.
5. WHO WHO. *Universal eye health: a global action plan 2014–2019*. 2014. [papers3://publication/uid/89EFE756-0939-4C4F-8CA8-EE71417BC689](https://publications/uid/89EFE756-0939-4C4F-8CA8-EE71417BC689).
6. Cieza A, Kocur I, Mariotti S, et al. The future of eye care in a changing world: call for papers. *Bull World Health Organ* 2017;**95**:667.
7. Buchan JC, Norman P, Shickle D, et al. Failing to plan and planning to fail. Can we predict the future growth of demand on UK Eye Care Services? *Eye* 2019; 1029–31. <https://doi.org/10.1038/s41433-019-0383-5>.
8. Drug and Therapeutics Bulletin. *The management of dry eye*. 2016. <https://doi.org/10.1136/dtb.2016.1.0378>.
9. Edwards N. *Community services: how they can transform care*. 2014.
10. The Scottish Government. *A national clinical strategy for Scotland*. 2016.
11. Cooper R, Guillaume L, Avery T, et al. Nonmedical prescribing in the United Kingdom: developments and stakeholder interests. *J Ambul Care Manag* 2008;**31**:244–52.
12. Cope LC, Abuzour AS, Tully MP. Nonmedical prescribing: where are we now? *Ther Adv Drug Saf* 2016;**7**:165–72.
13. Crown J. *Review of prescribing, supply and administration of medicines*. 1999.
14. Stewart D, MacLure K, George J. Educating nonmedical prescribers. *Br J Clin Pharmacol* 2012;**74**:662–7.
15. General Optical Council. *General optical council*. 2019. www.optical.org. [Accessed 22 August 2019].
16. Maskrey M, Johnson CF, Cormack J, et al. Releasing GP capacity with pharmacy prescribing support and New Ways of Working: a prospective observational cohort study. *Br J Gen Pract* 2018;**68**:e735–42. <https://doi.org/10.3399/bjgp18x699137>.
17. Graham-Clarke E, Rushton A, Noblet T, et al. Facilitators and barriers to non-medical prescribing – a systematic review and thematic synthesis. *PLoS One* 2018;**13**: e0196471–18, <http://dx.plos.org/10.1371/journal.pone.0196471>.
18. Weeks G, George J, MacLure K, et al. Non-medical prescribing versus medical prescribing for acute and chronic disease management in primary and secondary care. *Cochrane Database Syst Rev* 2016;**11**:CD011227. <https://doi.org/10.1002/14651858.CD011227.pub2>.
19. Kiely PM, Cappuccio S, McIntyre E. Optometry Australia scope of practice survey 2015. *Clin Exp Optom* 2017;**100**:260–9.
20. Johnson D, El-Defrawy SR, Hollands S, et al. Drug-prescribing patterns among optometrists and nonophthalmologist physicians at a tertiary care centre in Kingston, Ontario. *Can J Ophthalmol* 2016;**51**:168–73. <https://doi.org/10.1016/j.jcjo.2016.04.001>.
21. Raghunandan R, Tordoff J, Smith A. Non-medical prescribing in New Zealand: an overview of prescribing rights, service delivery models and training. *Ther Adv Drug Saf* 2017;**8**:349–60.
22. Hindi AMK, Seston EM, Bell D, et al. Independent prescribing in primary care: a survey of patients', prescribers' and colleagues' perceptions and experiences. *Health Soc Care Community* 2019;**27**:e459–70. <https://doi.org/10.1111/hsc.12746>.
23. Hindi AMK, Jacobs S, Schafheutle EI. Solidarity or dissonance? A systematic review of pharmacist and GP views on community pharmacy services in the UK. *Health Soc Care Community* 2019;**27**:565–98. <https://doi.org/10.1111/hsc.12618>.
24. Alvarez-Madrado S, McTaggart S, Nangle C, et al. Data resource profile: the Scottish national prescribing information system (PIS). *Int J Epidemiol* 2016;**45**:714–715f.
25. NHS National Services Scotland ISD (ISD). Information Services Division. <https://www.isdscotland.org>.
26. NHS Digital. *Practice level prescribing: glossary of terms*. 2018.
27. Janetos TM, French DD, Beaumont JL, et al. Geographic and provider variations in ocular hypotensive medication claims among medicare Part D enrollees. *J Glaucoma* 2019;**28**:E29–33. <https://doi.org/10.1097/JG.0000000000001114>.
28. The Scottish Government. *Community eyecare services review*. 2017.
29. Jonuscheit S, Loffler G, Strang NC. General ophthalmic services in Scotland: value for (public) money? *Ophthalmic Physiol Opt* 2019;**39**:225–31. <https://doi.org/10.1111/opo.12632>.
30. The Royal College of Ophthalmologists. *The way forward*. 2017.