Greater Manchester Connected Health City (GM CHC)
Stroke Clinical Care Pathway
Work stream 3

Stroke Secondary Prevention

Final report

CLAHRC Greater Manchester

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1. Abstract

Introduction

There is a high risk of recurrent stroke for all patients who suffer a stroke or transient ischemic attack (TIA) in the weeks following the initial event, with most recurrent strokes occurring within 90 days. In order to investigate the prevalence, frequency, and methods to reduce the occurrence of secondary/recurrent stroke in Manchester, the Greater Manchester Connected Health City (GM CHC) Secondary Prevention Workstream was commissioned.

Methods

Firstly, to gain a greater understanding of the current landscape of stroke care and recurrence within Salford, a large cohort of data was acquired via the Salford Integrated Record (SIR) and Sentinel Stroke National Audit Programme (SSNAP). This cohort of data was to provide an insight into how well stroke patients are currently managed to blood pressure and atrial fibrillation targets within Salford. We also introduced three pilot interventions in three separate GP practices in Salford. Including enhanced communication links with the Early Supportive Discharge team, an increased role for practice-based pharmacists, and the introduction of the Performance Improvement plaN GeneratoR (PINGR) software on the practice system. A qualitative evaluation also took place alongside the introduction of pilot interventions into practices.

Results

The cohort of SSNAP data identified 1,628 strokes between 31/12/12 to 13/11/17, and during the same time period, a subset of the SIR data identified 3,817 patients who had experienced a stroke. Due to the discrepancy in the number of records, data cleaning identified 2,995 of the patients as having either a stroke or TIA. Of these, 1,424 (47.5%) of the patients were identified as having a stroke in SSNAP within the same time period. The remaining discrepancy in the data is likely due to SSNAP not recording TIAs. Of the cohort only 38.7% had a record of their systolic blood pressure, 2.5% were recorded as having atrial fibrillation prior to stroke, and only 22% had received an ECG at some point. The pilot interventions revealed through the PINGR system that there were only 22 patients who were discharged in Salford over a 12-month period who were not under the care of the ESD team, the communication link between practice staff and the ESD team has now been established and will continue usage beyond the project, and the practice-based pharmacists were keen to scale-up their enhanced role in stroke care, despite the limited number of patients identified within the practice during the project period.

Conclusion

The quality and discrepancies within the SIR and SSNAP data have revealed that current recording and coding practices for stroke are not accurate enough and that improved recording will lead to better monitoring of patients post-stroke. The three pilot interventions were successful in being introduced in

practice and will continue to be utilised beyond the end of the project. However, due to the limited scale of all three, further funding is unlikely to scale up any of the three interventions at this time.

2. Introduction

There is a high risk of a recurrent stroke in the days and weeks after the initial event. There is also a 17% 5-year risk of myocardial infarction (MI) or vascular death after stroke (around 3% per year). Cardiovascular risk is greatly reduced for ischemic stroke and transient ischemic attack (TIA) patients by anti-platelet therapy, statins, blood pressure (BP) control, early carotid endarterectomy (where indicated), and anticoagulation for those with atrial fibrillation (AF). Intracerebral haemorrhage (ICH) patients also benefit from excellent long-term blood pressure control. Whilst antiplatelet and statins are typically started prior to hospital discharge, blood pressure control and anticoagulation often require ongoing investigation and review, requiring further input in the community. From published cohorts and our own data, around two-thirds of recurrent strokes within 90 days happen in the first 30 days.

In order to explore measures to reduce the occurrence of these recurrent or "secondary" strokes, the Secondary Prevention project was commissioned in collaboration with Connected Health Cities Greater Manchester, Salford Royal NHS Foundation Trust, The Greater Manchester Stroke Operational Delivery Network, and NIHR CLAHRC Greater Manchester in 2017.

3. Project aims and objectives

The aim of the secondary prevention project was to identify the prevalence of recurrent stroke and aim to identify measures to reduce recurrent stroke within 90 days of the index event, and myocardial infarction and vascular death within 1 year of the index event, for Salford residents.

4. Methods

4.1. Salford Integrated Records Data Request

To better understand the current state of stroke care within Greater Manchester, a larger data request was submitted to the Centre for Health Informatics, with a view to gathering a full Salford Integrated Record (SIR) dataset which would then be linked to historical primary care GP data in Salford and acute secondary care data to create a large cohort of stroke and TIA patients as the main focus of the workstream. A model for predicting the patients at highest risk of stroke and TIA could then feasibly be developed using this cohort of data The SIR data request was to focus on the following measures for patients post-discharge:

- Atrial fibrillation (AF) occurrence, detection, and treatment
- Blood pressure (BP) measurement
- Blood pressure management

The purpose of the SIR dataset was to monitor the exact treatment of AF, including the delay between identification and treatment action, documentation of the presence of AF, and use of anti-coagulant

medication. In terms of BP the delay in acquiring BP measures, the frequency of measures, and any use or changes to hypertensive drugs. The size of the cohort was estimated to be around 6,500 patients, for whom we could then identify the proportion of patients had a recurrent stroke and what actions were taken in their post-discharge care.

Table 1: Measures to be included within acquired data

Clinical target	**Required post-stroke monitoring and care**
Management of hypertension	● Do patients have BP recorded within 30 days of stroke? ● What is the average Systolic BP (2 or more measurements) for 90 days post-stroke? ● Have patients achieved the target BP (<130/80) ● How long did it take to achieve this target?
Management of AF	● How many patients are missing ambulatory ECG monitoring within 90 days following a stroke? ● How long did it take for the patient to receive an ECG? ● When AF is detected, how long until treatment with anticoagulants started?
Balancing measures	● Are any haemorrhagic complications present? ● Has the patient had any falls? ● Are any renal complications present?

4.2. Sentinel Stroke National Audit Programme Data Request

We also acquired data from the Sentinel Stroke National Audit Programme (SSNAP). This is a national healthcare quality improvement programme that is based at Kings College in London, UK (SSNAP, 2019). It measures the quality and organisation of stroke care in the NHS and is the single source of stroke data in England, Wales and Northern Ireland.

4.3. Pilot Interventions

In addition to the SIR/SSNAP data requests, we developed three pilot interventions for introduction in three GP practices within Salford as potential ways to improve the quality of secondary prevention following discharge from acute care. In order to develop the interventions we first mapped out the secondary prevention processes within the system (see Appendix B). We then held 4 x stakeholder meetings, which took place between January 2018 and September 2018. Secondary Prevention Stakeholder meetings were held at Salford Royal Foundation Trust and involved representation from all stakeholders (GM Stroke ODN; GPs, including one with CCG transformational lead responsibilities; ESD nurses; Practice Based Pharmacy leads; CHC project team members). The three pilot interventions were developed over the course of the 4 meetings to address stakeholders' understanding and

experience of existing failings within the acute stroke post-discharge system. The interventions are described below:

Intervention 1: Following the development and introduction of the Performance Improvement plaN GeneratoR (PINGR) in selected practices in Salford, the Health e-Research (HeRC) team at The University of Manchester, as well as IT staff from SRFT, worked with practices currently using PINGR to set up a regular data transfer from SRFT EPR into the PINGR system. The aim was for PINGR to provide system alerts to practice staff when a patient was discharged into their care following a stroke. The aim of these alerts was to serve as reminders to the relevant GPs and nursing staff to schedule an appointment with a recently discharged patient to provide the necessary post-stroke care, including detection and management of AF and hypertension, blood pressure checks, and pulse checks. Intervention 1 was rolled out in Langworthy Medical Practice.

Intervention 2: The development of shared guidelines of care between the Early Supportive Discharge (ESD) team and primary care staff, as well as a dedicated communication link between the two, aimed to improve the post-stroke management of identified post-stroke patients within St Andrew's Medical Centre. The shared guidelines detailed the requirements for the detection and treatment of hypertension and AF and provided clear guidance on patient follow-up appointments, blood pressure checks, and other care measures. This direct email link between the ESD team and practice staff also aimed to enable more direct communication and efficient feedback.

Intervention 3: Working with the dedicated practice pharmacists at The Poplars Medical Centre we aimed to increase the role of the practice-based pharmacists in the management of secondary stroke following discharge. This included creating a formalised structure for identifying patients following a stroke-related discharge from hospital and inviting all at-risk patients for a pharmacist consultation within two weeks of discharge. The pharmacy team would assist with the management of AF and hypertension, conduct all necessary post-stroke checks, and make prescription decisions to improve patient outcomes.

In addition to the three interventions, a stroke-specific training package, developed by GM Stroke ODN, was made available to all practice staff involved in the project and promoted more widely through Salford CCG. Following the introduction and piloting of these interventions within the practices, further developments such as the use of patient facing apps and wearables to allow improved home BP monitoring and AF detection will be considered.

4.4. Qualitative work

As the pilot interventions were only being introduced into three GP practices, we identified that there would be a relatively small number of stroke patients and/or subsequent occurrences of secondary strokes/cardiovascular events up to CHC final report deadline of March 2019; therefore, it was unlikely for any changes to be significant. Because of this, we undertook a small qualitative evaluation to explore the development of the 3 interventions as they were introduced into practice.

At the time of writing the report, we conducted 6 semi-structured face-to-face interviews with relevant stakeholders and clinicians and attended one secondary prevention meeting to conduct non-participant observation. Interviews were digitally audio recorded and transcribed verbatim (and anonymised during the transcription process). Interviews lasted between 24 and 55 minutes (average mean length = 35 minutes). Data was analysed using thematic analysis.

5. Results

5.1. SIR, SSNAP, and PINGR data

We applied for an extract of data from the Salford Integrated Record (SIR), which is an electronic health record (EHR) that is accessible to both primary and secondary care, with entries recorded from Salford Royal Foundation Trust (SRFT) and the general practices which fall within the Salford area. Such a record is a valuable source of information to get a better understanding of a patient's medical history and encounters with medical practitioners, enabling more informed decisions for current care. However, this relies on the coding within SIR to be accurate.

It is a common problem with EHRs that coding of medical symptoms, diagnoses and treatments is not always accurate. This can be due to a lack of training or familiarity with the system as well as time pressures, which mean that coding practices are suboptimal. Coding problems are evident within the data extracted from SIR and we will describe these in more detail.

The patients that make up the cohort are those, which had an occurrence of a stroke code within their record from 2007 to 2017. This led to a cohort of 6,567 patients and a total of 8,209,732 coded entries. With each coded entry, there is the opportunity to enter some textual description of diagnosis, meaning that the same code could be used with a different meaning. This suggests that those who are coding within SIR find it difficult to find the appropriate code or feel that the codes do not give enough granularities and additional information is required. This poses problems when analysing the data because the true meaning of the code and text is not always clear. Things such as spelling mistakes and different levels of information provided within the text also make it difficult to establish uniformity between coding of conditions.

We began by comparing the coding within SIR to that recorded in the Stroke Sentinel National Audit Program (SSNAP). This national audit is deemed to be a gold standard with respect to auditing patients that have experienced a stroke. Since the SSNAP data only covers 31/12/12 to 13/11/17, we constructed a subset of the SIR data for the same time period. Within this period, 1,628 strokes were recorded in SSNAP consisting of 1,462 patients and 3,817 were recorded in SIR using the Read codes beginning with G66, which is supposed to be used for a stroke, consisting of 2,159 patients. Other codes are also used for recording strokes, for example G61 is used for strokes due to ICH. This means that the numbers here are underestimates of the true numbers of patients and strokes coded in SIR. The coverage of the recording across the sources is summarised in Table 2.

Table 2: Number of patients, which are recorded in the data sets as having at least one stroke using only codes beginning with G66, between 31/12/12 and 13/11/17.

	In SSNAP	Not in SSNAP
In SIR	1288	871
Not in SIR	174	Unknown

If we examine this further, we can look at the dates of the recordings of the strokes and see if they match. In order to allow for a lag, any stroke recorded within 1 day of another was regarded as the same stroke. This resulted in 3,177 strokes recorded in SIR and 1,613 strokes recorded in SSNAP. The results of trying to match these strokes between SIR and SSNAP are given in Table 2.

Table 3: Number of strokes, which are recorded in the data sets as having at least one stroke using only codes beginning with G66, between 31/12/12 and 13/11/17.

	In SSNAP	Not in SSNAP
In SIR	912	2265
Not in SIR	701	Unknown

This discrepancy makes the data impossible to interpret since we do not know why strokes, which are recorded in SSNAP, do not appear to be recorded in SIR. It could be evidence of stroke patients, which are not acknowledged by the GP that they have experienced a stroke, which would be really valuable information, or it could simply be a lack of effort to code into the system. These have very different consequences in terms of actionable improvements to the pathway.

Further work was conducted to try and clean the coding for a stroke and transient ischemic attack (TIA) diagnosis, involving reviewing free text from other stroke codes as well as a search for common stroke and TIA terms within free text entries from all codes. The cleaned diagnosis identified 2,995 of the patients as having either a stroke or TIA. Of these, 1,424 (47.5%) of the patients were identified as having a stroke in SSNAP within the same time period (31/12/12 – 13/11/17). However, we might expect a large discrepancy here since TIAs are not captured within SSNAP. When comparing the cleaned entries with those identified from using the codes beginning with G66, only 1,862/2,159 (86.2%) were considered a true diagnosis for a stroke or TIA, with the remainder either having too much uncertainty or was clearly identifiable as not a stroke or TIA.

We were interested in how well a patient's risk factors were monitored and treated. Atrial fibrillation (AF) and high blood pressure were identified as key risk factors in recurrent strokes and TIAs. The procedure, which is often followed for detecting AF, involves a series of ECGs. Hence, we aimed to identify patients that had received an ECG, using the code '32...'. Using the cleaned coding, only 730/2995 (24.4%) patients appeared to have had an ECG done at some point. Using the SSNAP data, only 321/1462 (22%) patients were recorded as having an ECG, and of these only 76 were within 90 days after the recorded stroke. It could be that this is a poor representation of the pathway because of inaccurate coding practices, or it could be the case that patients are not well monitored for AF. The

code ‘G573’ was used to identify patients that were diagnosed with AF. Out of the SSNAP cohort, 49/1,462 (3.4%) were recorded as having AF within 90 days of the stroke and 36/1,462 (2.5%) were recorded with AF prior to the stroke.

When assessing how well blood pressure was monitored, we used the code ‘246A.’ for diastolic blood pressure recordings and ‘2469.’ for systolic blood pressure. For the diastolic blood pressure readings, 566/1,462 (38.7%) from the SSNAP cohort patients had at least one systolic BP recording within 90 days from the stroke. The median time of the first recording since the event (as recorded in SSNAP) was 6 days, with an inter quartile range of 2 to 15 days. The mean number of recordings was 1.44 and the median was one, indicating that little monitoring was conducted under the assumption that the data is an accurate reflection of the events. The mean recording was 75.25, which was calculated by first finding the mean for each patient and then taking the mean. The median of the mean measurement per patient was 75, with an inter quartile range of 68 to 82. Similarly, for the systolic blood pressure readings, 569/1,462 (38.9%) from the SSNAP cohort patients had at least one systolic BP recording within 90 days from the stroke. The median time of the first recording since the event (as recorded in SSNAP) was 6 days, with an inter quartile range of 2 to 15 days. The mean number of recordings was 1.44 and the median was one, indicating that little monitoring was conducted under the assumption that the data is an accurate reflection of the events. The mean recording was 144, which was calculated by first finding the mean for each patient and then taking the mean. The median of the mean measurement per patient was 136, with an inter quartile range of 124 to 150.

Table 4: Summary of recording of risk factor measures for patients who were recorded as having a stroke within SSNAP

	Read Code	SSNAP patients with at least one measurement in 90 days	Median (IQR) number of recordings within 90 days	Median (IQR) value of mean recordings within 90 days
Diastolic BP	246A.	566	1 (1-2)	75 (68-82)
Systolic BP	2469.	569	1 (1-2)	136 (124-150)
ECG	32...	76	1 (1-1)	-

5.2. Introducing pilot interventions into practice

5.2.1. Intervention 1

Delays were experienced in gaining the necessary data sharing agreements between SRFT and PINGR system (these were approved by November 2018) and then further delays were experienced waiting for the software engineer to make the necessary changes in the PINGR system to include stroke patient data. However, the PINGR system was successfully installed with the stroke data in January 2019, with the capacity to accurately detect and provide alerts to practice staff for any patients discharged from SRFT solely into the care of the practice. The PINGR system is able to

provide the relevant BP and AF information for practice staff and could therefore have a practical application if rolled out more widely.

PINGR identified anonymised information that 22 stroke/TIA patients were discharged from SRFT to GP practices within Salford in the 12 months previous to its implementation, who were not currently under the care of the ESD team or other community teams. As none of these patients were discharged to the Langworthy practice, it was not possible to further assess their care needs or provide any action to manage their care. Furthermore, at Langworthy Practice, only one GP was currently using the PINGR system within their practice, although two other GPs had recently been given training in the PINGR system.

5.2.2. Intervention 2

The email communication link was successfully established between ESD team and St Andrew's Medical Practice at the end of September 2018. As of February 2019, the communication link had been used by the ESD team for a couple of patients. A short proforma email had been developed for reporting high blood pressure measurements but this had not yet been used because patients' needs had been more complex than simple BP management (e.g. ESD team had reported a patient who had side effects from BP medication alongside high BP measurements).

Whilst it was hoped that the established communication link would enable better communication between the ESD and primary care, in the early days of its establishment, ESD team had not received feedback from the GP surgery and only knew of the outcome of the communication link through the patients' accounts. However, as of February 2019, the GP who leads the project at this practice is now engaged in the direct communication between ESD and St Andrew's, to ensure that referred patients are followed up and relevant feedback can be provided.

The practice staff and team plan to continue to use this link beyond the end of the CHC stroke project. ESD staff found the email link a reliable and systematic way to communicate patient information to the GP practice; however, they were still unsure regarding what types of problems, beyond blood pressure measurement, were acceptable to refer via the email link. They would like to extend the use of the communication link to include issues such as medication management, driving issues etc. The development of the shared stroke guidelines for the ESD team was completed by the project leads and ESD team in early 2019, and whilst not implemented as planned within the practice, the new documentation will be in place for all relevant SRFT staff.

5.2.3. Intervention 3

From December 2018, the practice-based pharmacist team (n=2) at The Poplars Medical Centre established a two weekly-automated search for recently discharged stroke patients (patients identified through having a 'read code' of stroke/TIA following discharge from hospital within the last 3 months).

A small number of patients were identified within the first two months of running the searches; however, no post-stroke pharmacist consultations had yet been conducted (as patients had already

been reviewed by a GP). Whilst consultations with pharmacists had not occurred in the short time of evaluation, it was felt that the identification of patients through the automated search had contributed to patients receiving timely GP appointments, which were considered to be more focused on post-stroke management.

There was an appetite to scale up the intervention across all practice based pharmacists within the Swinton area - it was felt that practice based pharmacists had the capacity to take on this extra workload due to the small numbers of patients involved and given that patients could be reviewed in the (practice based pharmacist run) AF clinics already established in GP practices across the area.

6. Impacts

Intervention 1 (PINGR): Due to the relatively small number of patients identified by PINGR over the previous 12 months (n=22), it is unlikely that there is the need for a larger project to target such a small group. The wider use of PINGR would be able to assist with the monitoring and management of these patients within Salford, and the system is readily available in approximately 16 Practices in the area at present. However, at present it is unclear how many GPs make use of the PINGR system within these practices. The identification of these 22 patients at greater risk of secondary stroke may result in an increase in the involvement of the ESD team to cover all discharged patients following stroke/ TIA.

Intervention 2: As the guidelines for stroke care have now been developed by the ESD team, they will be implemented within SRFT for continual use in post-stroke care within the organisation beyond the closing of the CHC stroke project. Similarly there are no further maintenance costs or requirements for the communication link with St Andrew's Medical Practice and as a result its use will continue beyond the project. The ESD team will have the capacity to set up similar dedicated links to other GP practices in Salford should its use from February 2019 onwards prove beneficial for management of patients.

Intervention 3: The impact of this finding could be to implement similar practices within other Salford GP practices, including sharing the basic checklist for identifying relevant patients, created by the project team (Appendix C).

7. Discussion and Conclusion

Whilst the PINGR data revealed a relatively small number of patients currently not under the care of ESD (n=22) and likely to be at risk of not meeting AF and BP management targets, there is still a concern that management of post-stroke can be improved within Salford. The implementation of the three stated interventions demonstrated moderate success as all three practices were able to engage with the project, however due to the small number of patients involved in these three pilots and the relatively short timescale for monitoring, there is no evidence that these have directly affected the likelihood of secondary stroke for any patients in Salford. The ESD shared guidelines and communication link between ESD and St Andrew's will be used beyond the closure of the project and the checklist provided to the practice-based pharmacists may assist them in continuing with their high-

level of post-stroke monitoring, meaning there is potential in all three areas to explore QI initiatives as part of the current NHS England priorities around improving stroke care.

In its current state, the data in SIR is not believed to be accurate for evaluating the care received by patients that have experienced a stroke. When considering only the patients that are recorded in SSNAP as having a stroke, we can see that alarmingly few patients are recorded as being followed up with blood pressure monitoring or AF detection. The data is likely to be an underestimate of the true levels of monitoring. However, there is a possibility that patients are not being well followed up. An improvement in coding practices would help us to monitor the secondary prevention care that is received by patients, and potentially help us to identify milestones in which certain risk factors should be monitored to reduce the number of patients experiencing recurrent strokes.

8. Future plans/sustainability

Potential future funding applications are currently being explored by the project team as well as the feasibility of the introduction of PINGR across the whole of Salford, though this would require a greater level of funding. It is unlikely that a significant amount of funding would be made available for replicating and scaling up the secondary prevention project, but there is the potential for further QI initiatives to improve secondary stroke care across the region, and particularly if a project could be designed and commissioned for the whole of Greater Manchester, in order to target a more significant patient group.

9. References

Kings College London. (2019) About the Sentinal Stroke National Audit Programme (SSNAP). available at: https://www.strokeaudit.org/About-SSNAP.aspx [Accessed on 1 Feb. 2019].

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