Report prepared for St John


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Executive summary

The objective of this evaluation is to review the structure, safety and success of St John’s clinical hub in Auckland, which operated as a proof-of-concept over the period July 2014 to June 2015.

The clinical hub was designed to provide secondary telephone triaging to less urgent 111 calls, with the expectation that many calls could be resolved over the telephone without the need for an ambulance to be dispatched (so called ‘hear and treat’). 111 callers interacting with the clinical hub could receive advice from trained clinicians on self-care options, be redirected to alternative healthcare providers, or if considered necessary, have an ambulance dispatched to their location.

The expectation was that the clinical hub would reduce volumes of patients being unnecessarily transported to Emergency Departments (EDs), would improve patient health outcomes by connecting patients to the most appropriate form of care, and would support better management of low acuity conditions in the community through the delivery of integrated care. By reducing the volumes of low acuity ambulance incidents, the clinical hub would also free up ambulance resources, enabling more rapid responses to priority incidents.

Our conclusion: the clinical hub delivers outcomes that improve on the status quo
The clinical hub provides a valuable tool for undertaking secondary triaging of less urgent 111 calls. There is strong evidence that it represents a material improvement on the status quo and there is likely to be a compelling case for expanding the clinical hub to a national footprint.

The clinical hub resulted in a material reduction in ambulance transports to ED
Over the course of the 12 months the clinical hub handled 24,388 incidents, of which 8,499 were resolved over the telephone without an ambulance being dispatched. This ‘hear and treat’ activity represents 6.8% of all emergency ambulance incidents in Auckland during that period.

Our best estimate is the clinical hub resulted in 5,369 fewer ambulance transports to Auckland EDs over the 12 month period. This represents 5.9% fewer ambulance transports to ED than would otherwise have taken place.

The clinical hub performs relatively well compared to international benchmarks, particularly considering it is the hub’s first year of operation. Internationally, ambulance services that have been running secondary telephone triaging for several years resolve between 7.5% - 12% of all ambulance incidents over the phone (St John resolved 6.8%). We would expect the clinical hub to become more successful over time; indeed, the volume of calls handled by the hub increased over time, with the hub also having a greater impact on ED transports over the latter half of the 12 month evaluation period.
The clinical hub has inherent risks, but St John is currently providing a clinically safe service

The greatest risk when providing clinical telephone advice to 111 callers is that the call-taker will not be able to identify a serious and urgent condition that might otherwise have been picked up if an ambulance attended the scene. This risk cannot be eliminated, but we understand St John to have taken reasonable steps to minimise this risk to patients.

Our examination of case files over the 12 months identified some areas that indicate heightened risks for some patients from secondary triaging:

- 37 patients who received telephone advice from the clinical hub after ringing 111 made their own way to ED and were assessed on arrival as being at triage level 2: ‘imminently life-threatening, or important time-critical’. None of these patients were advised by the clinical hub to make their own way to ED, although most were urged to seek timely attention from their GP or A&M.

- Although the elderly and young make up relatively small proportions of clinical hub users, they are considerably more likely than any other age group to be promptly admitted to hospital after receiving ‘hear and treat’ advice from St John.

Nevertheless, a clinical audit of 101 ‘high risk’ cases concluded that the hub is set up to provide a clinically safe service. The review panel concluded that St John should have dispatched an ambulance in 10 of the 101 reviewed cases, while in 2 of those cases the panel concluded the patient had suffered an ‘adverse event’ due to the delay in care being provided (with a 3rd case being a ‘possible’ adverse event). A number of recommendations from the clinical audit have been made to St John, most of which St John had already identified through its internal processes.

In our opinion St John has appropriate quality assurance standards in place. This includes the training and auditing of staff members, a process of monitoring and case review, and robust clinical governance processes to oversee the operation of the hub. We observe there are likely to be opportunities where St John can explore patient outcomes resulting from ‘hear and treat’ to identify opportunities for improving the hub’s operation.

The clinical hub provides tangible benefits for St John

Beyond the reduction in ambulance transports to ED, the clinical hub has also benefited St John in several ways.

The clinical hub has precipitated a significant drop in the proportion of incidents requiring ambulance transportation from the scene and provided the equivalent of an additional ambulance being available 24/7 for 277 days of the year. The clinical hub also supported St John’s efforts to manage demand for ambulance services from frequent 111 callers, with non-urgent ambulance call-outs to repeat patients falling by 46% in 2014/15.

This freeing up of ambulances has enabled St John to refocus ambulance resources on responding to the more serious ‘purple’ and ‘red’ priority incidents and to improve

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1 The clinical audit sampled 101 cases where the patient received ‘hear and treat’ advice from the clinical hub after ringing 111, but was subsequently admitted to hospital within 7 days and stayed at least overnight.
ambulance response times. During the 12 month evaluation period Auckland had the biggest improvement in urgent incident response times across New Zealand.

The clinical hub also reduced demand for secondary services
Our best estimate is the clinical hub reduced overall ED presentations by 4,248 during the period July 2014 to June 2015. This represents a 1.1% reduction in total ED presentations across the five Auckland EDs for the year.

This reduction in ED attendances would also have had an impact on inpatient volumes across Auckland hospitals. We estimate the clinical hub was likely responsible for between 212 to 425 fewer hospital admissions across Auckland during the period July 2014 to June 2015.

Any impact on demand for primary care services would be immaterial at the individual practice level
As a result of the clinical hub reducing ambulance dispatches to 111 callers and advising patients on alternative care options, it is intuitive that there would be an increase in demand for primary care services.

Our analysis is that the maximum impact the clinical hub might have had on demand for primary care was 8,022 new consultations over the 12 month period. This represents an increased demand for primary care consultations in Auckland of 0.2% or 22 new consultations per day across the region; a figure that would be unobservable for individual practices. In our opinion this is very much an upper bound and the true impact is likely much lower.

Our interviews with primary care clinicians at Auckland’s largest A&Ms confirm that no-one identified the hub as driving any increases in patient volumes. All clinicians we spoke to were supportive of the intent of the clinical hub and efforts to ensure patients can be seen in primary care when appropriate.

The clinical hub provides benefits to many 111 callers, but unsuccessful ‘hear and treat’ can inject considerable delay if an ambulance is ultimately needed
Those clinical hub users receiving ‘hear and treat’ advice benefit by receiving clinical advice tailored to their needs, including being put in touch with health services that are more appropriate to their needs than an ambulance response and ED transportation.

A survey undertaken of hub users demonstrates that that clinical hub is delivering a valuable and well-received service to the majority of users, with high levels of satisfaction. There was a small proportion of callers (approximately 11% to 13%) that were very dissatisfied with the decision not to immediately dispatch an ambulance. Some level of dissatisfaction is to be expected given the dramatic shift the clinical hub represents to the traditional ambulance operating model and these levels of dissatisfaction are comparable with similar services overseas.

However, in situations where the clinical hub determines a patient requires an ambulance then the intervention of the clinical hub will have likely led to material delays in the ambulance reaching the scene of less urgent incidents. For example, ambulances arrived to the scene of the least urgent ‘grey’ 111 calls, on average, 12 minutes and 25 seconds later in 2014/15 compared to the previous year. In our view, freeing up ambulance resources to
attend more urgent incidents is a desirable outcome of the clinical hub. However, the current delays in ambulance attendance at less urgent incidents is somewhat concerning when one considers that 65% of incidents handled by the clinical hub still required an ambulance to be dispatched. We expect St John to continue to invest in improving the ‘hear and treat’ success rate (including targeting those incidents most amenable to telephone resolution), which will help reduce the delays associated with ambulance arrivals at less urgent incidents.

Finally we note the clinical hub can benefit 111 callers in instances where an ambulance is still dispatched by providing an opportunity for a more detailed clinical assessment and for changes to be made in the priority assigned to ambulance dispatches. Notably, the clinical hub upgraded the initial triage codes assigned to 374 patients from ‘grey’/’green’ (not urgent, not serious) to ‘red’ (potentially life threatening) – which may well have provided very real medical benefits to those patients.

Recommendations
The clinical hub is delivering clear benefits to 111 callers, St John, and the wider health system. However, we have identified a number of areas through this evaluation where improvements might be possible to the clinical hub model. These include:

1. As St John has limited visibility of what ultimately happens to 111 callers, we recommend St John work with DHBs to set up an ongoing data-matching mechanism to identify which ‘hear and treat’ users are subsequently presenting to secondary services. Using this dataset of patient outcomes, and incorporating a feedback loop for ED clinicians, we recommend St John review on an ongoing basis whether there are opportunities to improve the clinical hub’s performance with respect to their handling of ‘high risk’ patients, which would include:
   (a) reviewing all cases where someone receiving ‘hear and treat’ dies within 7 days,
   (b) reviewing all cases where someone receiving ‘hear and treat’ presents to ED within 24 hours and are assessed as triage level 2 (‘imminently life-threatening, or important time-critical’) or triage level 1 (‘immediately life-threatening’), and
   (c) reviewing a random sample of other instances where ‘hear and treat’ patients present to ED, including any that ED clinicians identify as being of concern.

2. St John to undertake a work programme to continually improve the ‘hear and treat’ resolution rate. In particular, St John should review the impact the clinical hub is having on two categories of 111 calls where we consider resources are not yet being effectively applied:
   (a) ‘falls’: ‘falls’ was the most common condition the clinical hub dealt with (22% of all incidents) yet was the least likely condition to be resolved over the telephone (only a 23% success rate). The category was also identified through the clinical audit as an area of heightened risk for ‘hear and treat’, and also prompted a disproportionate number of complaints about the clinical hub (37% of all hub complaints were about how the clinical hub handled a 111 regarding a fall).
   (b) advice to the elderly and very young: these two groups were materially overrepresented in hospital admissions following the receipt of ‘hear and treat’ advice from the clinical hub. These are clearly higher-risk demographics for the provision of clinical telephone advice and there may be specific
conditions/circumstances that can be identified where ambulance transportation is likely to be highly beneficial for the patient.

3. Rather than operating solely on a call-back basis, we recommend St John investigate the case for introducing selective warm transfers of 111 calls to the clinical hub for certain incidents where there may be heightened risks if the initial 111 call is ended (e.g. mental health).

4. St John to develop a business case that examines the costs and benefits of options that better link 111 callers to healthcare services, including options for hub staff directly making GP appointments, making referrals, transferring callers to primary care, and contracting for follow-ups.

5. The inherent risks associated with telephone triaging would be reduced if the clinical hub staff had access to the patient records of the 111 caller. The concept of electronic shared records is not just a St John issue and is being explored at a national level. We recommend that St John stay abreast of developments on this issue and look at this as a priority area to explore in the future.

6. St John’s development of the clinical hub should consider flexible resourcing and accelerating providing on-road advice for paramedics:

(a) St John to review the case for moving away from a 24/7 clinical hub service and instead provide extra staffing during periods of peak volume. The clinical hub was not particularly busy (and had less of an impact on ambulance transports) between midnight and 5am; while the hub’s activity did not increase commensurably during the busiest period for St John (10am to 2pm).

(b) There are likely to be opportunities where the clinical hub’s role can be expanded to support ambulance officers attending an incident in an effort to reduce transports from the scene (so called ‘see and treat’) – by providing clinical support and by linking the patient to other healthcare and social services.

7. We separately provided St John with four recommendations from the clinical audit, including:

(a) St John to review the recommendations being made by Odyssey and staff training for 7 types of higher risk incidents, including abdominal pain in the elderly, rigours in the elderly, falls in the elderly, patients unable to mobilise, falls from height, child in severe pain, and elderly patients with co-morbidities who are referred to a GP afterhours.

(b) St John to adopt a clear policy for dealing with speakers of other languages. St John put in place a contract with a translation service in March 2015.

(c) St John to review 16 cases where auditors considered the medical history taken by the hub was poor and assess whether additional training in taking accurate and effective medical histories is needed.

(d) St John to explore the ability to integrate more fully with the regional health system, including ways to access notes and provide referrals and notifications to a range of services.
1. Introduction

Sapere has been contracted to evaluate the ‘proof-of-concept’ of St John’s clinical hub in Auckland over the period July 2014 to June 2015.

Sapere had previously developed an evaluation framework that set out how the clinical hub should be evaluated.\(^2\) That framework outlined the methodology and approach we would use when undertaking this evaluation.

1.1 A new ambulance service model

St John faces a challenging operating environment, with growing demand for ambulance services against a background of constrained resources. Through the Better, Sooner, More Convenient healthcare programme the Government is also placing renewed emphasis on ensuring the delivery of patient care occurs at the right place at the right time – which for many patients may require delivery of integrated care within a community setting.

From a health system perspective, unplanned care can be a significant driver of costs. Acute medical and accident care also poses challenges for the delivery of high standards of clinical care. St John therefore has considerable opportunity both to deliver financial benefits and improved capacity to the health system and to improve standards of care for patients.

St John is looking to implement a service delivery model that transforms its services and its interaction with the wider health sector. In essence, St John is moving away from a traditional ambulance transport model towards the professionalisation of the ambulance services and integration with other clinical services.

The intended net effect of these interventions is that patients will receive a better outcome from being connected to the right service at the right time, with St John and EDs benefiting from a resulting increase in their capacity. At a high level, the net benefit to the health system of the new service delivery will be determined by number of patients St John and its partners can assist either directly or indirectly to utilise more appropriate (and lower cost) modes of treatment.

1.2 What is the clinical hub?

St John has developed a new service model, which will operate around a 111 clinical hub. The clinical hub was tested as a ‘proof of concept’ in Auckland and has operated as a 24/7 service from 1 July 2014. It was used within the coverage areas of the three DHB areas of Auckland, Waitemata and Counties Manukau.

1.2.1 The objectives of the clinical hub

The three overarching objectives of the clinical hub service are:

1. to improve patient health outcomes by connecting patients to the right care, at the right time and in the right place,
2. to manage low acuity 111 calls more effectively and efficiently in the community through better integrating St John services with other urgent care and primary health services, and
3. to reduce the number of patients that arrive by ambulance to hospital EDs in the Auckland region by at least 6,000 per year.

1.2.2 How does the clinical hub operate?

Emergency calls coming into the St John Northern Communications Centre are coded under the ProQA system. Following a scripted call an algorithmic system assigns one of 1,200 Medical Priority Dispatch System (MPDS) codes to the call as well as a priority, which will then inform ambulance dispatch decisions. St John priorities are automatically coded in order of clinical urgency:

- purple (immediately life-threatening),
- red (immediately life-threatening or time-critical),
- orange (urgent/potentially serious),
- green (non-urgent), and
- grey (not serious or life-threatening).

The clinical hub was introduced to offer a secondary triaging process for less urgent 111 calls. The operation of the hub has evolved during the proof-of-concept:

- Initially only ‘grey’ calls were transferred through to the clinical hub, with ‘green’ and ‘orange’ priority calls receiving a screening from a paramedic / clinical advisor who manually identified calls that should be referred to the hub.
- Since November 2014 all ‘grey’ and ‘green’ calls were transferred through to the clinical hub nurse, with incident selection being applied to other calls.

Secondary triaging and telephone advice

The clinical hub is staffed by registered nurses who ring the caller back and then take the caller through a clinical triage using Odyssey software (as opposed to ProQA, which is a relatively basic triage system designed to identify levels of urgency). The triage nurse will either recommend a range of options to the caller (including self-care, or that the caller contact their GP within a defined period, or that the caller make their own way to urgent care) or will allocate a response determinant to the incident, which will then be assigned to the queue for an ambulance dispatch.

Also sitting within the clinical hub is an intensive care paramedic, who provides call-back reprioritisation for moderate acuity cases that are currently in the queue for an ambulance response (primarily ‘orange’ and ‘red’ priority calls). The paramedic is not necessarily expected to resolve the calls over the phone, but to gather more information from the
patient to assist with decisions on ambulance dispatch priorities as well as provide first aid advice where appropriate.

In circumstances where clinical hub staff have been unable to contact the 111 caller they will try a second time 10 minutes later (mobile users will also receive a text asking them to clear the line). If this second call is also unsuccessful then the incident will be assigned to the queue for ambulance dispatch. Calls initially triaged as ‘grey’/‘green’ will be assigned a ‘green’ triage code for ambulance response; while any ‘orange’, ‘red’ or ‘purple’ calls handled by the paramedic would have remained in the queue for dispatch as per their initial triage under ProQA.

Secondary triaging only takes place when clinical hub staff can talk to the patient or someone who is physically with the patient; otherwise the incident is transferred into the queue for ambulance dispatch.

Supporting on-road changes

The clinical hub also provides a resource for ambulance officers attending an incident. The officers can contact the hub and seek clinical advice as to next steps – which might include treating the patient at the scene (including providing advice on self-care) or transporting the patient to ED or another destination. The hub therefore support efforts by St John to increase the proportion of ‘see and treat’ cases, whereby paramedics attending a call-out are able to successfully treat the patient at the scene rather than transporting them.

1.2.3 An international trend towards ‘hear and treat’

There is a growing international consensus that the use of secondary telephone triaging for non-urgent calls can be used to safely reduce the volume of ambulance dispatches. St John’s development of the clinical hub is certainly consistent with steps being taken by many ambulance services overseas.

International literature indicates that ‘hear and treat’ is likely to focus on the lowest acuity calls. As such, while it may be highly effective at reducing dispatches, it will not have the same impact on reducing ED transports (i.e., some of these patients would otherwise have been treated at the scene by ambulance offices), and will have minimal impact on hospital admissions from ED (i.e., even if these patients would have otherwise been transported to ED, they would not have subsequently been admitted to hospital).

1.3 Structure of this report

Section 2 of this report describes the approach we have taken to evaluating the clinical hub. Section 3 then provides an overview of the key metrics for the operation of clinical hub, including the incidents handled, the nature of the conditions patients were calling about, and the advice given.

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The report then evaluates how the clinical hub performed against the following key indicators, including:

- how the clinical hub affected volumes of ambulance transports to ED (Section 4),
- the clinical safety of the hub (Section 5),
- the impact of the clinical hub on St John activity (Section 6),
- the impact of the clinical hub on secondary services (Section 7),
- how the clinical hub affected primary care services (Section 8), and
- the impact of the clinical hub on patients (Section 9).
2. Our approach

2.1 Nature of the evaluation

The evaluation framework Sapere developed has enabled a mixed ‘impact’ and ‘outcomes’ evaluation to take place. We have examined the impacts and outcomes of the clinical hub – describing the delivery of services through the hub, the impacts resulting from the hub’s operation, and determining the overall outcome attributable to the hub with respect to key measures.

We have not been asked to facilitate a value-for-money evaluation. St John already has a detailed understanding of its own cost structures and the cost of delivering the hub, and St John and the Ministry of Health have already agreed the performance payments based on ED transport volumes that the hub is deemed to have prevented. St John wants the evaluation to provide a clear picture of the impact of the hub across a range of health services.

This evaluation provides our assessment of the impact of the hub and will assist St John and policy makers to decide whether the benefits are sufficient to support continuation/expansion.

2.2 Evaluating the impact of the hub

The approach taken in this evaluation will answer the key question of how the clinical hub has affected ambulance transports to ED and will also provide an important insight into the impact the hub is having on other parts of the health system.

The evaluation focuses on the following indicators:

1. **Primary measure**: what was the impact of the hub on St John transports to ED?

2. **Secondary measures**:
   - (a) What was the impact on **St John**? This evaluation component will look at how the hub affected the volume of incidents dealt with by St John, its impact on ambulance responses, and changes in the nature of transports, including with respect to priority, location, time of the day, and day of week.
   - (b) What was the impact on **secondary services**? The evaluation explores the overall impact of the hub on ED attendances (including self-presentations) and inpatient admissions.
   - (c) What was the impact on **primary care**? Given the focus on reducing ambulance transports it is important to consider the extent to which patients are being displaced to other parts of the health system – most notably being primary care and Accident & Medical Centres (A&Ms).
   - (d) What was the impact on **patients**? The evaluation will examine the extent to which patients are positively/negatively affected by the hub and how their behaviour may change over time.
3. **Operational performance** of the hub: how has the clinical hub performed during the proof-of-concept?

The impact the clinical hub has on transports to ED is described as the ‘primary measure’ for the evaluation. However, we note the impact on ED transports is not as a pass/fail test. This will be a complex evaluation that will need to consider the impact of the clinical hub across all key measures.

Figure 1 below maps how this framework and the accompanying indicator set we have developed fit together.
Figure 1- Indicator Set

Evaluation Map: Key Indicators for St John Clinical Hub

Primary Measure
- What was the impact of the hub on St John transports to ED?
  - Impact on ED transports = counterfactual - factual
  - Monthly monitoring against time series projection

Secondary Measures
- What was the impact of the hub on St John?
- What was the impact of the hub on secondary services?
- What was the impact of the hub on primary care?
- What was the impact of the hub on patients?

Operational Performance
- How has the clinical hub performed?

Impact on ED transports
- Impact on incident volumes
- Impact on ambulance response times

Impact on EDs
- Changes in total ED presentations
- Changes in nature of ambulance presentations

Impact on inpatient admission volumes

Impact on demand for primary care services
- Volume of hub users visiting primary care
- Changes in ambulance transports to non-EDs

Views of primary care on impact of hub
- Changes in primary care patients going to ED

Patient outcomes / satisfaction
- Survey of hub users
- Hub users presenting at ED
- Clinical review of cases
- Adverse events and complaints

Key operational metrics
- Review of clinical decision making

Where benefits are likely accruing, by:
- Patient characteristics
- Condition
3. The operational performance of the clinical hub

This section outlines the key metrics for the clinical hub for the period July 2014 to June 2015, including calls handled, the nature of the conditions transferred to the clinical hub and the advice provided to callers.

3.1 Key metrics: 20% of all emergency incidents interacted with clinical hub

The proof-of-concept for the clinical hub covered the period 1 July 2014 to 30 June 2015. During this period:

- there were 124,091 St John Emergency Ambulance Service (EAS) incidents within the Auckland District;
- of these, 24,388 incidents (20%) were transferred to the clinical hub, where a triage nurse or paramedic interacted directly with the caller. Of these:
  - 15,889 incidents (65%) had an ambulance dispatched to the scene (of which 11,044 incidents resulted in a transport to ED); and
  - 8,499 incidents (35%) were resolved with some form of clinical telephone advice being given and with no ambulance being dispatched (which we term as ‘hear and treat’).

The median call duration for 111 calls that subsequently went through to the clinical hub was 3 minutes and 17 seconds. The median duration before the clinical hub rang the caller back was 1 minute and 44 seconds after the initial 111 call was completed (the mean for this call back period was 4 minutes and 20 seconds). The median duration of the call with the clinical hub was 12 minutes and 23 seconds.

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4 A survey of hub users found 73% thought the call back times were quicker than, or about what they thought it would be; while 23% thought that the call back should have been either a bit or a lot sooner. See Appendix 7 for more detail on the survey results.
The following diagram maps the outcomes and advice given to 111 callers who interacted with the clinical hub in Auckland.

**Figure 2 - Map of clinical hub outcomes, year to 30 June 2015**

From the above map we can make the following observations:

- The clinical hub appears to have a high utilisation rate, with 20% of all Auckland 111 incidents being transferred to the hub. As we examine later, this is a particularly high throughput when compared internationally.

- The high throughput of the clinical hub is a likely explanation for the relatively high proportion of incidents (65%) that subsequently require an ambulance to be dispatched to the scene.\(^5\) The relatively high rate of ambulance dispatch may indicate that hub resources are not being selectively targeted to those incidents that are capable of resolution over the phone.

- Although the hub may be reducing transports, there is a sizeable proportion of incidents where patients either explicitly refuse the clinical advice provided or where the call is incomplete due to the patient hanging up. This accounted for 11% of instances when phone-based advice was attempted (940 cases over the 12 months).

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\(^5\) The proportion of clinical hub incidents requiring an ambulance dispatch fluctuated between 60-69% over the course of the 12 months, with no discernible pattern.
3.1.1  Age profile of clinical hub user is relatively middle-aged

A survey of 480 clinical hub users shows an even split between female (51%) and male users (49%). The chart below shows the age profile of those surveyed. There is a higher make-up of middle-aged callers than we expected, with relatively few very young and very old patients being passed through to the clinical hub for secondary assessment.

Of note:

- Those aged 19 and under made up only 8% of clinical hub users, whereas the same population comprised 29% of all Auckland ED presentations during 2014/15.
- Those aged over 81 comprised 8% of clinical hub users, compared to 9% of all ED attendances.

This may indicate that when the very young and very old ring 111 their condition may be initially assessed as being relatively urgent, making them less likely to be transferred through to the clinical hub for secondary triaging.

3.1.2  The hub appropriately focused on the least urgent calls

Table 1 below shows that the overwhelming majority of incidents being handled by the clinical hub were the least urgent 111 calls – those calls initially triaged as ‘grey’ and ‘green’.
Table 1 - Composition of calls handled by the hub

<table>
<thead>
<tr>
<th>Triage code</th>
<th>Make-up of all incidents handled by hub (100%)</th>
<th>Proportion of incidents resolved without ambulance being dispatched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey</td>
<td>13,858 (57%)</td>
<td>41%</td>
</tr>
<tr>
<td>Green</td>
<td>8,806 (36%)</td>
<td>28%</td>
</tr>
<tr>
<td>Orange</td>
<td>718 (3%)</td>
<td>25%</td>
</tr>
<tr>
<td>Red</td>
<td>959 (4%)</td>
<td>24%</td>
</tr>
<tr>
<td>Purple</td>
<td>8 (0%)</td>
<td>0%</td>
</tr>
<tr>
<td>Patient Transfer Service</td>
<td>24 (0%)</td>
<td>0%</td>
</tr>
<tr>
<td>Private Hire</td>
<td>13 (0%)</td>
<td>8%</td>
</tr>
<tr>
<td>Air Transfer</td>
<td>2 (0%)</td>
<td>0%</td>
</tr>
</tbody>
</table>

As one would expect, the clinical hub was much less successful at resolving incidents over the phone that had initially been triaged by the 111 call taker as being an urgent or time-sensitive incident ('purple', 'red' and 'orange').

We note these more serious incidents are handled by the paramedic within the clinical hub (not the clinical nurse) and intervention by the clinical hub in these incidents does not necessarily mean there was an expectation that the call would be resolved over the telephone. For these cases the incident remains in the queue for ambulance dispatch, with the paramedic ringing the 111 caller back to assist with priority within the category, and if appropriate, to provide first aid advice while the ambulance is dispatched.

3.1.3 Falls were the most common incident presenting to the clinical hub

The most common category of incident handled by the clinical hub was ‘fall’, with 5,284 falls constituting 22% of all hub incidents over the 12 month period. This was followed by incidents recorded as ‘sick person’ at 16%, trauma incidents at 11% and abdominal pain at 10%.
Table 2 below shows the nature of the incidents being handled by the clinical hub (as identified by the initial 111 call taker using ProQA) and their rates of resolution. The columns in the table below respectively show:

- All incidents handled by the hub.
- The number of ‘grey’/‘green’ incidents: these are the incident volumes that are being targeted for ‘hear and treat’ by St John by the clinical hub nurse. These figures exclude all serious incidents (‘orange’/‘red’/‘purple’ incidents) where a paramedic sitting within the clinical hub contacts the patient to assist with ambulance prioritisation decisions or to provide first aid advice while the ambulance is dispatched.
- Those ‘grey’/‘green’ incidents that were resolved over the telephone with no ambulance being dispatched (i.e. ‘hear and treat’).
- The proportion of ‘grey’/‘green’ incidents resolved through ‘hear and treat’: due to the exclusion of paramedic calls, the resolution rate of 36% shown in this table is slightly higher than the overall resolution rate of all incidents interacting with the clinical hub (35%).

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6 Appendix 1 provides a full list of how we aggregated the 332 distinct incident conditions handled by the clinical hub into higher-level categories for analysis.
### Table 2 - incident category frequency and outcomes

<table>
<thead>
<tr>
<th>Category</th>
<th>All incidents handled by the hub (hub nurse and MTS)</th>
<th>Number of ‘grey’/‘green’ incidents</th>
<th>Number of ‘grey’/‘green’ incidents resolved with no ambulance dispatch</th>
<th>Proportion of ‘grey’/‘green’ incidents resolved through ‘hear and treat’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>5,284</td>
<td>5,176</td>
<td>1,193</td>
<td>23%</td>
</tr>
<tr>
<td>Sick person</td>
<td>3,958</td>
<td>3,776</td>
<td>1,528</td>
<td>40%</td>
</tr>
<tr>
<td>Trauma</td>
<td>2,905</td>
<td>2,727</td>
<td>959</td>
<td>35%</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>2,509</td>
<td>2,399</td>
<td>1,000</td>
<td>42%</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1,890</td>
<td>1,831</td>
<td>672</td>
<td>37%</td>
</tr>
<tr>
<td>Other</td>
<td>1,320</td>
<td>1,161</td>
<td>575</td>
<td>50%</td>
</tr>
<tr>
<td>Back pain</td>
<td>1,190</td>
<td>1,183</td>
<td>322</td>
<td>27%</td>
</tr>
<tr>
<td>Faint</td>
<td>986</td>
<td>814</td>
<td>383</td>
<td>47%</td>
</tr>
<tr>
<td>Immobility</td>
<td>843</td>
<td>843</td>
<td>201</td>
<td>24%</td>
</tr>
<tr>
<td>Fever</td>
<td>553</td>
<td>553</td>
<td>270</td>
<td>49%</td>
</tr>
<tr>
<td>Non-recent injury</td>
<td>421</td>
<td>421</td>
<td>158</td>
<td>38%</td>
</tr>
<tr>
<td>Breathing difficulty</td>
<td>367</td>
<td>167</td>
<td>108</td>
<td>65%</td>
</tr>
<tr>
<td>Assault</td>
<td>295</td>
<td>269</td>
<td>114</td>
<td>42%</td>
</tr>
<tr>
<td>Psych/abnormal behaviour</td>
<td>286</td>
<td>206</td>
<td>95</td>
<td>46%</td>
</tr>
<tr>
<td>Rash/Allergy</td>
<td>265</td>
<td>242</td>
<td>128</td>
<td>53%</td>
</tr>
<tr>
<td>Headache</td>
<td>262</td>
<td>220</td>
<td>100</td>
<td>45%</td>
</tr>
<tr>
<td>Chest pain</td>
<td>260</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Cramp/Spasm/Joint Pain</td>
<td>232</td>
<td>232</td>
<td>87</td>
<td>38%</td>
</tr>
<tr>
<td>General Weakness</td>
<td>197</td>
<td>197</td>
<td>69</td>
<td>35%</td>
</tr>
<tr>
<td>Hazardous substance</td>
<td>169</td>
<td>144</td>
<td>82</td>
<td>57%</td>
</tr>
<tr>
<td>Pregnancy related</td>
<td>123</td>
<td>103</td>
<td>42</td>
<td>41%</td>
</tr>
<tr>
<td>Fit</td>
<td>51</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Stroke</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>24,388</strong></td>
<td><strong>22,664</strong></td>
<td><strong>8,086</strong></td>
<td><strong>36%</strong></td>
</tr>
</tbody>
</table>
3.2 Outcomes vary considerably by incident type

As outlined in the above table, although 36% of ‘grey’/‘green’ 111 incidents dealt with by the clinical hub were resolved over the telephone, there is considerable variation in this ‘hear and treat’ rate within conditions:

- The hub is highly successful in alleviating the need for an ambulance dispatch for incidents regarding breathing difficulties (65% of such incidents were resolved over the telephone), hazardous substances (57%) and incidents regarding rashes and allergies (53%).
- The hub has a much less successful intervention rate when a patient’s condition was initially recorded by the 111 call taker as being a fall (23%) or relating to immobility (24%).

The following graph illustrates how often an incident in a particular category was resolved over the telephone without the need for an ambulance dispatch.

Figure 3 – ‘Hear and treat’ successful resolution rate

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7 65% of hub incidents resulted in an ambulance being dispatched. 45% of all incidents handled by the clinical hub ended up with the caller being transported to ED by ambulance.
Where incident categories are more likely to be resolved without an ambulance dispatch we can infer that incidents in these categories are, on the whole, less urgent and more amenable to clinical telephone advice and redirection to other healthcare providers.

Interestingly, although falls were the most common condition handled by the clinical hub (22% of all incidents), the clinical hub was less likely to resolve such cases than any other condition (only 23% of such cases were resolved without an ambulance being dispatched).

We are aware the Odyssey guidelines for falls were reviewed in November 2014, but the above statistics (and relatively high levels of patient dissatisfaction and the risks associated with falls that were identified through the clinical audit – both of which are examined later in this report), indicate there are still likely to be opportunities within the falls category to better target the resources of the clinical hub; for example, potentially excluding from the hub 111 calls concerning falls amongst the elderly or falls from heights.

**Recommendation:** St John to undertake a work programme to review the impact the clinical hub is having within the falls category and to identify whether the resources of the clinical hub could be better applied.
3.2.1 Most callers are advised to see their GP or visit an A&M promptly

Examining the advice provided by the clinical hub provides an insight into the likely impact of the hub on the patients. The impact on patients is examined later in Chapter 7.

Figure 4 and Table 3 below both show the advice provided to the 8,499 incidents that were resolved without an ambulance response (i.e. ‘hear and treat’ cases).

Figure 4- 'Hear and treat' advice
### Table 3 - 'Hear and treat' advice

<table>
<thead>
<tr>
<th>Advice</th>
<th>Incidents receiving advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancelled</td>
<td>10%</td>
</tr>
<tr>
<td>Incomplete / advice refused by patient</td>
<td>11%</td>
</tr>
<tr>
<td>Response / advice not required</td>
<td>4%</td>
</tr>
<tr>
<td>Self-care</td>
<td>13%</td>
</tr>
<tr>
<td>Make own way to ED</td>
<td>9%</td>
</tr>
<tr>
<td>See GP / A&amp;M</td>
<td></td>
</tr>
<tr>
<td>Seek care within 2 hours</td>
<td>19%</td>
</tr>
<tr>
<td>Seek care within 6 hours</td>
<td>21%</td>
</tr>
<tr>
<td>Seek care within 12 hours</td>
<td>2%</td>
</tr>
<tr>
<td>Seek care within 24 hours</td>
<td>8%</td>
</tr>
<tr>
<td>Routine GP visit</td>
<td>4%</td>
</tr>
<tr>
<td><strong>GP / A&amp;M sub-total</strong></td>
<td><strong>53%</strong></td>
</tr>
</tbody>
</table>

These figures indicate that many of the callers interacting with the clinical hub have relatively urgent conditions, with 59% of callers urged to either go promptly to ED or to seek medical attention within 6 hours. However, following secondary triaging, most patients agree that their condition does not require an ambulance response for ED level care.

#### 3.2.2 The nature of some incidents makes a strong case for the need for clinical triaging

St John’s efforts to provide advice over the phone to callers in lieu of an ambulance response are supported by the nature of some of the incidents that prompted callers to ring 111.

The clinical hub dealt with a number of incidents, which were no doubt of serious concern to the patients, but were of a nature that were clearly suited to treatment in primary care or self-management, rather than an emergency ambulance response. A sample of such 111 calls that the clinical hub dealt with during the 12 month period includes:

- 27 incidents where callers were having difficulty sleeping,
- 20 incidents relating to boils,
- 13 incidents of ‘itching’,
- 4 incidents of hiccups, and
- 4 requests to cut off rings.
In the absence of the clinical hub many of these incidents would have resulted in an ambulance being dispatched to the scene – no doubt providing a useful service to the patient but coming at the expense of ambulance capacity to deal with other more serious incidents.

### 3.3 Time of day / day of week activity

#### 3.3.1 The volume of incidents handled by the hub increased over time

As one would expect when launching a new model of care, it took some time for the new clinical hub to become fully embedded in how St John responds to incidents. As the chart below shows, the hub appears to have taken 5-6 months to scale up: it handled 1,416 incidents in the first month of operation (representing 13% of all St John incidents in Auckland in July 2014) and 2,189 incidents in the last month of the proof-of-concept period (21% of St John incidents in June 2015).

![Incidents handled by the hub](chart)

#### 3.3.2 The hub was busiest on the weekends

The two busiest days of the week for the clinical hub are on the weekend, where the hub is busier than one might expect given ambulance activity on those days. This is suggestive of there being 111 callers on Saturday/Sunday who are seeking assistance for conditions in instances where they cannot easily access primary care.

The chart below shows, by day of the week, the breakdown of clinical hub incidents compared to all St John transports in Auckland.
When looking at the hours of the day when the hub was busiest, it would appear that the clinical hub had a fairly consistent case load from 10am through to 9pm.

The chart below demonstrates that clinical hub activity did not increase to match the busiest period for St John transports (10am to 2pm) and that the hub was typically busier from 7pm onwards than one might expect given the drop-off of St John transport activity during this window. Such a trend is what we would expect if the hub was operating at capacity and was fully utilised from 10am to 9pm, rather than a flexible resourcing of the hub to align with when St John is busiest. This might suggest opportunities for the hub capacity to be increased to better support periods of peak St John activity.
4. The primary measure: impact of the hub on transports to ED

This section examines the impact that St John’s clinical hub had on ambulance transports to Auckland EDs during the year to 30 June 2015.8

As we outline below, the clinical hub had a material impact on ambulance transports to ED and our best estimate is that the hub was likely responsible for 5,369 fewer ambulance transports to Auckland EDs over the 12 month period. This represents 5.9% fewer ambulance transports to ED that would otherwise have taken place.

4.1 Selecting a modelling methodology

4.1.1 The high-level approach

Our 2014 evaluation framework outlined the methodology we would apply to measure the impact of the clinical hub on ambulance transports to ED.

The key question that the evaluation needs to answer is expressed below:

\[
\text{A reduction in ED transports attributable to the clinical hub} = \left( \text{St John transports to ED if there was no hub} \right) \text{ (the counterfactual)} - \left( \text{St John transports to ED with the hub} \right) \text{ (the factual)}
\]

As previously agreed through the evaluation framework, for the purpose of determining the impact of the clinical hub, we have used St John transportation data rather than ED data on ambulance arrivals.9

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8 There are five Auckland EDs relevant to this evaluation: Auckland Public Hospital, Middlemore Hospital, North Shore Hospital, Waitakere Hospital and Starship Hospital.

9 This is the same approach that Sapere took when evaluating the Urgency Community Care pilots in Kapiti and Horowhenua – an approach endorsed by a Steering Group comprising the Ministry of Health, St John, Wellington Free Ambulance and DHBs. In our experience DHB data on the volume of patients arriving by ambulance is routinely lower than the volume that ambulance services report as being transported to ED (and fluctuates considerably on an ED by ED basis). The systematic under-reporting at a DHB level is likely because ED staff are either not aware of the arrival mode of some patients (e.g. staff may be busy/distracted or because the patient is assumed to have self-presented) or because of poor data recording.
4.1.2 Key challenge: modelling the counter-factual

The key challenge for this evaluation is determining how many patients St John would have transported to Auckland EDs during the period July 2014 to June 2015, if there had been no clinical hub in place.

Modelling options

Through the development of the evaluation framework we considered a number of options for projecting the volume of ambulance transports to Auckland EDs if there was no clinical hub. These options and our assessments are described in detail in Appendix 2. At a high-level, the options included:

• attributing any change in transport volumes from previous year to the clinical hub,
• estimating likely ED transport volumes by applying the previous year’s transportation rate (the likelihood at which an incident results in a transportation to ED) to 2014/15 incident volumes,
• using ‘hear and treat’ volumes as a proxy for avoided ED transports,
• using time series modelling to extrapolate historic Auckland ED transportation volumes in order to project volumes for 2014/15, and
• identifying a control group elsewhere in New Zealand so actual 2014/15 data can be used to project likely ED transport volumes in Auckland for 2014/15.

In our 2014 evaluation framework we outlined our strong preference to use either time series modelling or control group modelling to project likely ED transport volumes. We tested 17 difference models and identified two preferences:

Two preferred models identified

1. A time series model

From 8 different time series models, we preferred an ARIMA model (autoregressive integrated moving average) to forecast the volume of emergency ED transports from 1 July 2014 to 30 June 2015. In essence, this is a time series model that uses historic ambulance data to project what would have occurred if there was no clinical hub in place.

2. A control group model

We also developed a control group model that accounts for the risks that there may be national trends occurring that would be unlikely to be identified through a time series model. The control group model we used takes into account changes in ED transports occurring in the Waikato, Coromandel and the Southern Lakes region. These three Districts were selected through a process of backward elimination, which involved starting with all candidate variables and testing the deletion of each variable until no further improvement is possible to the predictive qualities of the model.

The detail of the two models was developed 12 months ago as part of the evaluation framework before the possible impact of the clinical hub was known. As per the evaluation framework, there are pros/cons of both models and we determined that the decision on the most appropriate model should be left to the time of the evaluation. More information on the models is available in Appendix 2.
Choice of model: control group

With full datasets available we re-ran the two models to identify whether they could be improved and how accurately they could predict past (known) ED transport volumes:

- Time series model: the model had an average monthly prediction error of 163 ED transports.
- Control group model: the model has an adjusted R square of 88%, with an average monthly prediction error of 132 ED transports.

We believe the control group model best predicts what would have occurred if there had been no clinical hub operating in Auckland during the period of July 2014 to June 2015. The model has the smallest prediction error and, more appropriately, it accounts for any nationwide changes in ambulance demand during the proof-of-concept period (e.g. the results would take into account if there had been a less virulent flu season than previous years).

Assumptions with the modelling

While we consider the modelling to be robust and to be as accurate as practical, it is important to understand that our favoured model incorporates a number of assumptions. We have outlined below some of the possible limitations of the model, as raised by stakeholders – and our responses to them.

<table>
<thead>
<tr>
<th>Suggested limitations of the control group model</th>
<th>Sapere response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model will not account for changes in population base or in incident volumes</td>
<td>The selection of the control group assumes historical drivers of ambulance demand in Auckland will remain consistent. However, our analysis of the past 5 years of data shows that Auckland ambulance demand is highly predictable without having to explicitly factor in population growth. Actual 2014/15 data confirms that incident volumes were consistent with our previous projections.</td>
</tr>
<tr>
<td>Model will not account for other St John initiatives to reduce ED transports</td>
<td>If St John made additional interventions in Auckland in 2014/15 to reduce ED transports, then the model would attribute those impacts to the clinical hub. However, St John has confirmed here were no other material interventions during the evaluation period that might have had an impact on ambulance transports to ED.</td>
</tr>
<tr>
<td>Use of historic data may incorporate past efforts by St John to reduce ED transports and understate the impact of the clinical hub</td>
<td>The control group model will project a continuation of any historic initiatives to reduce ambulance demand if these were initiatives occurring in the control group areas. In our view it is reasonable for the counterfactual to include a continuation of nationwide demand changes for ambulance services.</td>
</tr>
<tr>
<td>Model will not reflect local changes (e.g. an ED changing opening hours)</td>
<td>The control group model will not account for any localised changes in the Auckland health system. However, our interviews have not identified any changes of such a magnitude that would affect St John ED transport volumes.</td>
</tr>
</tbody>
</table>
Suggested limitations of the control group model

Control group selection may not appropriately correlate to key characteristics of demand for ambulances in Auckland

Sapere response

We accept there is a risk that those Districts included in the control group will have materially different characteristics from Auckland. However, the selection of the control group was undertaken through a robust process of improving the model and correlations with Auckland were subsequently qualitatively explored (with Waikato and Coromandel in particular understood by interviewees to be closely linked to changes in demand in Auckland).

4.2 Our conclusion: the hub was responsible for a material reduction in ED transports

Our best estimate is that the clinical hub was likely responsible for reducing emergency ambulance transports to Auckland EDs by 5,369 during the period July 2014 to June 2015. This represents a reduction in transports of 5.9% on volumes that would otherwise have taken place. The key metrics are:

- **Counterfactual**: our best estimate is that in the absence of the clinical hub there would have been 91,087 St John EAS transports to ED in 2014/15 (as per control group modelling, see Appendix 6), and
- **Factual**: St John actually made 85,718 EAS transports to the five Auckland EDs during the period July 2014 to June 2015 when the clinical hub was in operation.

The plot below shows the impact of the clinical hub from July 2014.

**Figure 5 - Monthly volumes of Auckland St John transports to ED**
4.2.1 Interpreting the result

While we have made our best prediction of the impact of the clinical hub on ED transport volumes, some caution must be used when interpreting the results. Our model does not prove a causal link between the clinical hub and the reduction in ED transports, although we are confident in expressing our opinion that it is the contributing factor in the material reduction in transports in the 2014/15 year.

Furthermore, there is always the potential our model may under or over-state the impact of the clinical hub. The evaluation framework concluded the mid-point of the model’s estimate would be used for making judgments about the impact of the hub. However, the boundaries of the model mean that we can be 95% confident that the during the 12 month proof-of-concept for the clinical hub that ED transports reduced between 4,144 and 6,596.

We are confident in concluding the clinical hub had a statistically significant impact on ED transports within the Auckland region. Figure 6 below shows the increased impact of the hub over time, with transport volumes across most of the latter months falling outside the 95% confidence interval of our estimate of what would have occurred under the status quo.

**Figure 6 - Actual and forecasted ED transports, with 95% confidence interval**

4.2.2 Targeting ‘6,000’ fewer ED transports

As observed above, a key objective of the clinical hub was to reduce the number of patients that arrive by ambulance to hospital EDs in the Auckland region by at least 6,000 per year. We note St John and the Ministry of Health have agreed separate processes for determining whether St John met contractual performance targets.
The clinical hub’s use of ‘hear and treat’ is fairly consistent with international benchmarks

A scan of international literature and approaches adopted by other ambulance services shows that St John’s resolution of 6.8% of all 111 calls through ‘hear and treat’ would have been considered to be exceptionally high only 2-3 years ago, but is now slightly below average when compared to countries where ‘hear and treat’ has been actively promoted for several years.

We identified the following ‘hear and treat’ resolution rates:

• England:
  – English ambulance services successfully resolved 8.1% of calls through telephone advice in 2014/15. This was a material increase from 6% in 2012/13.
  – During a 12 week trial the South Western Ambulance Service (SWAS) resolved 10.6% of incidents with only telephone advice (increasing to 13.94% in 2015/16 YTD).
  – For other (NHS) ambulance services trusts during 2013/14, ‘hear and treat’ accounted for between 2.3% - 11.8%, with the lowest performer being North West (2.3%), and the highest performer being South East Coast (11.8%).

• Australia:
  – During 2013/14, Victoria Ambulance reported that 7.5% of calls went through their phone referral service with no need for an ambulance to be sent.

International experience indicates a ‘learning effect’ and we expect St John will continue to improve the performance of the clinical hub. By refining the triaging undertaken through the hub, training of staff, and identifying and targeting those incidents where the clinical hub is having the greatest impact, we would expect to see the resolution of incidents through ‘hear and treat’ increase from 6.8% in the near future.

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10 A comprehensive 2012 literature review concluded 6-9% of calls typically qualify for secondary triaging, with only 3-6% calls typically resolved over the telephone - Centre for Health Systems and Safety Research, ‘Secondary ambulance triage service models and outcomes: a review of the evidence’ (2012), University of New South Wales.
15 See Ambulance Victoria 2013-14 Annual Report
5. The clinical safety of the hub

Although St John has reduced ambulance transports to ED, it is important to examine whether this reduction has been achieved without compromising patient safety.

This section examines:

- the risks to patients from the clinical hub model,
- the clinical decision-making and identification of any safety concerns with the current model, and
- the appropriateness of quality assurance process for the clinical hub.

In this section we observe that the clinical hub model carries an inherent risk that serious and urgent incidents might go unrecognised by clinical hub staff. There is a particular concern about the volume of ‘hear and treat’ patients self-presenting to EDs with serious conditions. However, there is evidence that over the course of the 12 month period St John has significantly reduced the prospect of patients suffering adverse outcomes. A clinical audit of high-risk cases has also found the hub to be delivering a clinically safe service and we conclude that St John has appropriate levels of quality assurance and clinical governance.

5.1 The ‘hear and treat’ model carries inherent risks, albeit for a relatively small group of patients

The greatest risk when providing clinical telephone advice to 111 callers is that the call-taker will not be able to identify a serious and urgent condition that might otherwise have been picked up if an ambulance attended the scene – and that the patient is adversely affected. The clinical hub nurse cannot draw on the visual and non-verbal cues when undertaking the clinical assessment that would be of assistance to an ambulance officer attending the scene.

This risk to patients cannot be eliminated and can only be managed. We understand St John has appropriate procedures in place to minimise this risk.

5.1.1 International evidence confirms ‘hear and treat’ increases risks for some patients

While ambulance services have successfully been able to reduce ED attendances overseas, it invariably comes with a slight increase in the clinical risks to patients. This is intuitive – a patient seen by an ambulance officer will likely receive a superior assessment to a phone-based assessment (albeit a face-to-face service may not be necessary, may not be the most appropriate healthcare option, and may not be cost-effective).

There have been infrequent cases overseas where significant patient safety risks have arisen through secondary triaging where the call-taker has failed to recognise serious patient symptoms. A literature review of secondary triaging trials by ambulance services found one trial in the UK had two adverse events (0.05% of all incidents), while a Swedish study
found an average adverse incident rate of 0.13%. The literature makes clear these are not common occurrences.

As explored below in more detail, a clinical audit found 3 adverse events or potential adverse events from a sample of 101 high-risk cases handled by the St John clinical hub. If such events were normally distributed then this would indicate a possible adverse incident rate of 0.06% for 111 callers interacting with the clinical hub or 0.18% for those clinical hub users for whom an ambulance was not dispatched. We note this estimate should be treated as indicative only – it is unlikely the incidence of adverse outcomes is normally distributed and the actual incidence could be lower or higher than this estimate. Furthermore, while the clinical hub will increase clinical risks for some 111 callers, we are not in a position to comment whether that risk is greater or less that the risks that are inherently present in the delivery of other health services.

5.1.2 The volume of hub users self-presenting to ED with serious conditions represents a material ‘at risk’ group

By matching St John and ED datasets we were able to examine the circumstances of those patients who received phone-based advice from St John and then made their own way to an Auckland ED. The triage codes assigned to those patients by the ED departments provides a particularly valuable insight into the degree of urgency of the cases and the potential risks to patients who might have otherwise have received ambulance attention.

We identified 655 patients presented to Auckland EDs within 24 hours of calling 111 and receiving ‘hear and treat’ advice from St John. The table below shows how those patients were triaged on arrival by ED clinicians.

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16 See Centre for Health Systems and Safety Research, ‘Secondary ambulance triage service models and outcomes: a review of the evidence” (2012), University of New South Wales. This study documented instances in the UK and Australia where phone-based triaging (not just ambulance triaging) had impacted on patient health outcomes.

17 The audit found 2 adverse outcomes and 1 possible adverse outcome from a sample of 101 cases where the patient was admitted to hospital within 7 days after ringing 111. Data-matching with a 73.6% success rate for ‘hear and treat’ cases found 364 such instances of hospital admissions, meaning a likely population of 494 such hospital events if full data matching was available. Extrapolating the 3 possible adverse events to this group means there could be 15 adverse events over the 12 months, amongst those 8,499 patients receiving ‘hear and treat’ advice. 15 incidents amongst the 24,388 incidents handled by the clinical hub would mean 0.06% of hub users may have received an adverse outcome.

18 Information on the process of matching St John and DHB datasets is available in Appendix 3.

19 Although as examined below in section 7.1, due to data matching issues we estimate the real number of self-presentations within 24 hours to be approximately 1,121.
Table 4 - Triage codes for hub users self-presenting to ED

<table>
<thead>
<tr>
<th>ED triage code</th>
<th>Triage description</th>
<th>Number of hub users presenting to ED</th>
<th>Distribution of known hub users presenting to ED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Immediately life-threatening</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Imminently life-threatening, or important time-critical</td>
<td>37</td>
<td>6%</td>
</tr>
<tr>
<td>3</td>
<td>Potentially life-threatening, potential adverse outcomes from delay &gt; 30 min, or severe discomfort or distress</td>
<td>342</td>
<td>52%</td>
</tr>
<tr>
<td>4</td>
<td>Potentially serious, or potential adverse outcomes from delay &gt; 60 min, or significant complexity or severity, or discomfort or distress</td>
<td>267</td>
<td>41%</td>
</tr>
<tr>
<td>5</td>
<td>Less urgent, or dealing with administrative issues only</td>
<td>9</td>
<td>1%</td>
</tr>
</tbody>
</table>

Of concern is the 37 patients whose condition was assessed as ‘imminently life-threatening, or important time-critical’ when they self-presented to ED;\(^{20}\) a group representing approximately 0.6%\(^{21}\) of all 111 callers who received clinical telephone advice from the hub. These patients have conditions that require prompt medical attention and they are likely to have faced heightened risks from receiving telephone advice upon calling 111, particularly if their arrival to ED was delayed.

We accept that it is challenging to identify such cases over the phone, but the volume of these cases may indicate a material risk to the success of the clinical hub – if those volumes continue (and particularly if the hub is expanded beyond Auckland), then in all likelihood it would just be a matter of time until a patient suffers serious adverse consequences. Identifying the characteristics of such patients and the steps that can be taken to minimise risks to them is recognised as a key priority for St John.

None of these 37 callers were advised by the St John clinical hub to make their own way to ED, albeit most were advised to promptly seek medical attention:

- 20 patients were advised to seek medical attention within 2 hours,
- 13 patients were advised to seek medical attention within 6 hours,

\(^{20}\) 29 of these 37 patients were subsequently admitted to hospital for at least one night.

\(^{21}\) Although we identified 37 patients, there was only sufficient data to match 73.45% of hub users to ED data. It is therefore reasonable to estimate there could have been 50 hub users presenting to ED with triage level 2 conditions after receiving clinical telephone advice.
• 1 patient was advised to seek medical attention within 12 hours,
• 1 patient was advised to make a routine appointment with their GP, and
• 2 patients were given advice on how to self-manage their condition.

The fact that St John is recognising that most of those patients require prompt medical attention indicates the screening and triaging of calls by the hub is largely functioning well. However, it is concerning these particular patients had to make their own way to ED after ringing 111 and that they likely received delayed medical attention. As we outline below, there is likely to be an opportunity for St John to more systematically review the characteristics of these ‘at risk’ cases in more detail to identify learning opportunities and areas for improvement.

5.1.3 The ‘at risk’ group may be reducing over time

While ‘hear and treat’ patients self-presenting to ED with triage level 2 conditions is a concern, we have observed that the frequency of such occurrences has likely diminished over the course of the 12 month period.

Figure 7 below shows the proportion of month ‘hear treat’ incidents where a caller was known to subsequently have presented to ED and been assessed by a clinician as having a triage level 2 condition (imminently life-threatening, or important time-critical). The data provided by DHBs for the data matching purposes was not complete, so we have extrapolated volumes in February, May and June to better reflect the likely volumes if we had access to full datasets.
Figure 7 - Hub users self-presenting to ED with triage level 2 conditions (as a proportion of monthly ‘hear and treat’ outcomes)\textsuperscript{22}

The chart shows a possible decline over the 12 month operation of the clinical hub in the frequency of such incidents: with 26 in the first six months and 20 (estimated) in the second six month period. As we observe below, throughout the proof-of-concept period St John had a process of continue review and improvement in place and we consider that considerable improvements were made to the operation of the clinical hub over the proof-of-concept period.

5.1.4 Young and elderly 111 callers are likely at higher risk from telephone triaging

Examining inpatient records also provides a useful means of quantifying the size of the patient group who is at risk of being adversely affected by the clinical hub.

During the period July 2014 to June 2015, 364 patients received ‘hear and treat’ advice from the clinical hub and were admitted to hospital (at least overnight) within 7 days of ringing 111.\textsuperscript{23} As we examine below in relation to the clinical audit, it is not necessarily a failure of the clinical hub that these patients made their own way to hospital and it may be that an

\textsuperscript{22} We have estimated likely self-presentation volumes for the three months with missing ED data by assuming that ED volumes in those months comprised similar proportions of the annual volume as in the previous year.

\textsuperscript{23} This category of patients also captures the majority of the 37 patients presenting to ED with triage level 2 conditions – those deemed to be ‘imminently life-threatening, or important time-critical’.
ambulance transport was not necessary at the time. Nevertheless, it is amongst this group that there is a heightened risk that the provision of telephone advice may have had adverse consequences for the patients.

The characteristics of the patients subsequently being admitted to hospital highlight an opportunity for St John to consider refining the operation of the hub – and in particular, to manage the risks associated with particular demographics.

As Table 5 below shows, there are two age groups where clinical hub users are significantly over-represented in the ‘at risk’ groups: hub users aged under 20 and those aged over 81. Callers in those two patient groups make up relatively small proportions of clinical hub users, but are much more likely than any other age group to fall within the two ‘at risk’ groups we have identified – those assessed as being triage level 2 upon self-presentation to ED and those who are promptly admitted to hospital after receiving ‘hear and treat’ advice.

**Table 5 - Ages of clinical hub users and those users admitted to hospital after 'hear and treat'**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Age of all hub users&lt;sup&gt;24&lt;/sup&gt;</th>
<th>Age of those receiving 'hear and treat' and then being admitted to hospital</th>
<th>Age of those receiving 'hear and treat' and then being assessed as triage level 2 by ED staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 and under</td>
<td>8%</td>
<td>16%</td>
<td>32%</td>
</tr>
<tr>
<td>20-30</td>
<td>18%</td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>31-40</td>
<td>15%</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td>41-50</td>
<td>11%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>51-60</td>
<td>13%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>61-70</td>
<td>14%</td>
<td>11%</td>
<td>16%</td>
</tr>
<tr>
<td>71-80</td>
<td>13%</td>
<td>11%</td>
<td>16%</td>
</tr>
<tr>
<td>81+</td>
<td>8%</td>
<td>17%</td>
<td>11%</td>
</tr>
</tbody>
</table>

**Recommendation:** We recommend St John review the circumstances in which ‘hear and treat’ advice is provided for 111 calls from the elderly and very young. These are clearly higher-risk demographics for the provision of clinical telephone advice and there may be specific conditions/circumstances where St John can identify the case for triggering ambulance dispatches.

<sup>24</sup> From a survey of 482 hub users
5.1.5 There may be a case for a ‘warm transfer’ of certain 111 calls

The clinical hub model operates on a call-back model, were the caller is advised at the end of their 111 call that they will shortly receive a call from a nurse. Clinical hub staff then ring the caller back and take them through the secondary triaging process. On average it took 1 minute and 44 seconds for clinical hub staff to contact the patient.25

There are advantages to the call-back model, particularly in the flexibility it provides staff to prioritise call backs to more urgent incidents. As the clinical hub is co-located within the 111 call centre the nurses can often can talk to the original 111 call taker and dispatcher regarding incidents, priorities for call-backs and available ambulance resourcing.

The main alternative to the clinical hub model would be for the initial call taker to make a ‘warm transfer’, whereby the 111 caller stays on the line and is directly connected to the triage nurse for secondary triaging.

A warm transfer model can offer some advantages over the call-back model adopted by the clinical hub. Keeping the 111 caller on the line minimises the risks that can occur if there are difficulties or delays in trying to make contact with the original caller. It can also offer a superior call experience, with callers having greater clarity about the role of secondary triaging and whether an ambulance is on its way, and may also reduce some caller frustration (for example, 23% of surveyed hub users wanted the call-back to occur sooner).

We do not consider there is a compelling case to move away from the call-back model. But in our opinion St John needs to consider incorporating selective warm transfers into the clinical hub model. There are likely to categories of incidents where there are advantages to keeping the caller on the line. For example, mental health is an area where vulnerable people may be reaching out for help by calling 111, and there may be heightened risks if their 111 call ends with the caller being advised that someone else will contact them shortly.

**Recommendation:** There is a case for St John to investigate introducing selective warm transfers for certain 111 calls where there may be heightened risks if the initial 111 call is ended.

5.2 St John’s quality assurance processes are appropriate

St John has put in place appropriate systems to train staff, monitor performance and to implement service improvements. However, there is likely to be an opportunity for St John to formalise its processes for reviewing incidents where patients are at risk of suffering adverse events.

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25 There was considerable variation in the monthly average for the time delay before a call-back, ranging from 3 minutes and 33 seconds (July 2014) to 44 seconds (October 2014).
5.2.1 Clinical hub staff are highly trained and are subject to robust performance monitoring

The clinical hub is staffed by a supervising St John intensive care paramedic (who provides clinical support and oversight) and by a registered nurse(s) from Homecare Medical:

- The intensive care paramedic role is a senior position that existed prior to the formal establishment of the clinical hub. They originally focused on providing advanced 24/7 on-call clinical support and coaching for road crews and staff within the communications centre. With the establishment of the hub their role was expanded to provide call-back reprioritisation for moderate acuity cases (‘orange’ and ‘red’ priority calls, and some ‘green’ calls when nurses are overloaded), using St John’s Manchester Triage System.

- The registered nurses handled the vast majority of clinical hub calls (approximately 92%), working with low acuity callers, co-ordinating referrals and access to alternative pathways for patients, and working with ambulance staff. The nurses are from Homecare Medical, a provider of 24/7 telehealth services including nurse-based telephone consultations, care coordination, telephone-based screening and in- and out-of-hours practice administration support.

The nurses are extensively trained and monitored, and the guidelines are regularly reviewed by Homecare Medical's Clinical Governance Committee. Homecare Medical utilises a clinical decision support system, Odyssey Tele Assess. Globally more than 25 million telephone consultations take place annually using Odyssey in seven countries and seven languages.

Regular call audits are in place to ensure quality

We are satisfied that St John has robust procedures in place to monitor the individual decision making and behaviour of clinical hub staff. Staff received supervision and support that reflects a process of continual monitoring and review.

Each nurse undergoes an audit of a minimum of one call per 12 hour shift worked, with new nurses having two calls per shift audited until they have demonstrated consistent practices. Through this process the quality of the documentation and the calls’ overall clinical safety are assessed.

The nurses are also provided with 1:1 coaching including feedback on call review findings on a fortnightly basis by the Team Manager.

5.2.2 There is an appropriate level of clinical governance

To oversee the performance of the clinical hub St John established a clinical governance group with its partners. Membership of the group included:

- St John Medical Director
- Clinical Hub Manager
- Homecare Medical Director
- Homecare Medical Nurse Manager
- GP representative
- An Auckland DHB Primary Care representative.
The group met monthly to review the performance of the hub and to refine and improve the service. Its activity included reviewing the results of audits of calls to the clinical hub and receiving reports regarding clinical hub complaints, reportable events and monthly patient satisfaction surveys. The clinical governance group was therefore in position to identify any concerning trends in data, any training gaps for staff, and whether there was a need to review the clinical protocols being applied by hub staff.

St John has recently brought the clinical oversight of the clinical hub into the structure of the broader Clinical Control Services (CCS) Clinical Quality Group. CCS has clinical oversight of all emergency medical dispatch (including call handling and dispatch), the clinical hub and the clinical desk. This group includes HomeCare Medical and Wellington Free Ambulance.

We are satisfied that the structure put in place by St John was appropriate as a mechanism to monitor and improve the quality and safety of the clinical hub services.

**Over the course of the proof-of-concept, St John put in place a process of review and continual improvement**

During the clinical review process St John was asked to comment on the learnings they identified, and systems improvements they made, during the first 12 months of the clinical hub.

St John advised that following a continual review of processes/complaints their clinical governance processes they made a number of changes to improve the operation of the hub. A summary of these changes are listed below.

**Table 6 - Changes St John made to the operation of the hub, July 2014 to June 2015**

<table>
<thead>
<tr>
<th>Changes to the clinical hub:</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2014: Additional training provided by Dr Karl Cole – “Triaging of Abdominal Pain” – triaging of abdominal pain was put on hold for a week until the training was provided.</td>
</tr>
<tr>
<td>July 2014: The medical directors at Homecare Medical and St John underwent a review of the Odyssey Guidelines for infants under 5 years, abdominal pain, vomiting and diarrhoea.</td>
</tr>
<tr>
<td>July 2014: Implementation of an age criteria for Clinical Telephone Assessment (CTA): for patients under the age of 5 years, they can undergo CTA, but they must come to an outcome of referral i.e. their carers will not be provided with self-care advice only. Nurses have been formally instructed to always conclude with a recommendation for assessment at a medical facility.</td>
</tr>
<tr>
<td>September 2014: Training provided around the appropriate accessing of Primary Options for Acute Care (POAC) and training around what are appropriate presentations for A&amp;Ms and EDs.</td>
</tr>
<tr>
<td>September 2014: Implementation of MEDAS – an application that provides the nurse with the closest A&amp;M Clinic including whether it is an affiliated clinic.</td>
</tr>
<tr>
<td>October 2014: De-escalation training provided to clinical hub nurses</td>
</tr>
<tr>
<td>November 2014: Training for clinical hub staff regarding falls assessments particularly with the elderly and co-morbidities</td>
</tr>
</tbody>
</table>
In our opinion these changes reflect an appropriate process of ongoing learning and improvement by St John staff. They reflect St John’s recognition of higher-risk areas and identification of issues requiring additional training over the course of the proof-of-concept.

5.2.3 There is a need for a more systematic review of possible adverse patient outcomes

There were several pathways by which an incident handled by the clinical hub might be identified for internal review and through which areas for improvement might be identified:

1. **Call audits**: as noted above, each nurse had one call randomly selected per shift for review.

2. **Complaints**: all complaints from patients who interacted with the clinical hub are forwarded to the Clinical Manager (Clinical Control Services) for review. The Clinical Manager reviews the relevant 111 call and the clinical hub call and makes a decision on whether the complaint is upheld. Any resulting action plan to minimise similar events occurring in the future is monitored by the Strategic Leadership Team, with any clinical recommendations being forwarded to the Clinical Governance Group for consideration. Patient complaints about the clinical hub are examined in more detail below at Section 9.3.1.
3. **Daily screening of calls**: The Clinical Manager (Clinical Control Services) also screens each day’s log of clinical hub calls to identify possible issues of concern. For each patient the Manager compares the triage code assigned by the clinical hub against an ambulance officer’s assessment of the patient’s condition upon arrival to ED (for those patients that St John transports to ED) – and can therefore identify cases for review where the clinical hub may not have recognised the seriousness of an incident where the patient was subsequently transported to ED.

These opportunities for an incident to be reviewed for learning opportunities are critically important to the ongoing success of the clinical hub - both as a means of ensuring clinical hub staff are handling the calls appropriately, but also to review the protocols in place within the clinical hub and whether there are certain types of incidents where a clinical hub response may not be appropriate.

Our concern is that, at present, St John has very limited visibility of key ‘at risk’ patients – those that receive advice over the telephone, make their own way to ED, and arrive with very serious medical conditions. The only means by which St John is currently made aware of any adverse outcomes for those patients receiving ‘hear and treat’ advice is if the patient (or their family) subsequently makes a complaint to St John.

We consider there is a strong case for St John and DHBs to set up a regular process to identify the outcomes for those patients receiving ‘hear and treat’ advice (similar to the one-off exercise undertaken to facilitate this evaluation). Once this has been done then all ‘high risk’ outcomes should be regularly reviewed by St John to assess the appropriateness of their treatment by the clinical hub and whether there are areas for improvement.

**Recommendation**: As St John has limited visibility of patient outcomes, we recommend St John work with DHBs to set up an ongoing data-matching mechanism to identify which ‘hear and treat’ users are subsequently presenting to secondary services. Using this dataset, and incorporating a feedback loop for ED clinicians, we recommend St John review on an ongoing basis whether there are opportunities to improve the clinical hub’s performance with respect to their handling of ‘high risk’ patients, which would include:

- (a) reviewing all cases where someone receiving ‘hear and treat’ dies within 7 days,
- (b) reviewing all cases where someone receiving ‘hear and treat’ presents to ED within 24 hours and are assessed as being triage level 2 (imminently life-threatening, or important time-critical’), and
- (c) reviewing a random sample of other instances where ‘hear and treat’ patients present to ED, including those identified as being of concern by clinicians.

5.3 **A clinical audit shows the hub to be delivering a clinically safe service**

A clinical audit was undertaken to review a sample of patient files in order to establish the clinical safety of the clinical hub and to identify any safety concerns from the redirection process.
Our view is that the clinical hub is set up to provide a clinically safe service. Although there remains an inherent risk that some patients could be adversely affected by the operation of the clinical hub, St John has taken appropriate steps to minimise this risk.

5.3.1 The clinical audit methodology

101 cases were selected to review

Rather than reviewing a randomised sample of clinical hub cases, we decided to review a sample from a group of patients who faced the greatest risk of harm from the clinical hub – those patients who, after receiving telephone advice from the clinical hub, were admitted to hospital within 7 days of ringing 111 and stayed at least one night in hospital. Focusing the clinical audit on the group that was most likely at risk of suffering adverse consequences from receiving telephone advice after ringing 111 was considered an important means of identifying any issues with the operation of the clinical hub. The sample covered the first six months of the clinical hub’s operation.

From July 2014 to December 2014 there were 283 patients who were admitted to hospital for at least one day within 7 days of receiving ‘hear and treat’ advice from the clinical hub after ringing 111. From this population we used stratified sampling to select 101 cases to be reviewed from a mix of three types of cases:

1. Nurse-only cases: 86 cases were selected where the patient received telephone advice from nurses through the clinical hub utilising Odyssey software, where the nurse provided self-care advice or referred the patient to seek alternative care, which included:
   (a) 37 cases where the patient was advised to see a GP within 2 hours,
   (b) 25 cases where the patient was advised to see a GP up to 24 hours later, and
   (c) 24 cases where the patient was provided with self-care advice only.

2. Paramedic cases: 8 cases were selected where the incident was resolved by a paramedic through the clinical hub utilising the Manchester Triage System (MTS).

3. Complaints: 7 cases were selected where a patient interacting with the clinical hub subsequently made a complaint to St John.

As stratified sampling was used, the results from this audit are indicative rather than being a statistically representative sample. However, all cases from the sample population that were not randomly selected for the clinical audit were screened by Sapere’s (non-clinician) staff and we have no reason to believe the results of the audit would have been any different if the cases were selected differently. St John has committed to conducting an internal clinical review of all remaining cases from the sample population that were not audited.

The cases were reviewed by six clinicians

Six auditors participated in the audit. They were a PHO Clinical Director, a DHB Nurse Consultant, a DHB Deputy Clinical Head of Emergency Care, the St John Medical Director, the St John Clinical Manager of Clinical Control Services, and a Medical Director of the Primary Health Care Partnership.
The auditors were provided with records of the call from the St John system and the relevant discharge summaries from the hospitals.

The clinical audit was conducted using an electronic survey, followed by a workshop. The survey covered all 101 cases. We selected 34 cases to workshop where there was significant disagreement on whether the initial management was appropriate, or where at least one auditor thought there had been an adverse event. Cases that went to the workshop were discussed and agreed by consensus.

5.3.2 Key findings from the clinical audit

A separate clinical audit report has been provided to St John. What is presented here is a summary of the key findings from the review process.

Through the clinical audit process there was agreement that, of the 101 cases:

- 70 cases had been handled appropriately by St John, 24 cases had been handled inappropriately, and in 7 cases it was unclear if the management of the case had been appropriate.

- Of the 24 cases where St John’s management of the incident was considered to be inappropriate, the auditors identified 10 cases where St John should have, based on the information presented during the 111 call, dispatched an ambulance; and 3 cases where St John should have dispatched an assessment vehicle.

- There was a degree of commonality regarding the 10 instances where the reviewers considered an ambulance should have been dispatched to patients:
  - Unable to mobilise (3)
  - Child fallen from a height and in severe pain (3)
  - Rigours in the elderly (2)
  - Abdominal pain (2)

In 4 of these 10 cases, the auditors felt that the hub nurse had taken a poor history and had not asked the right questions to understand the situation. An example was where the nurse apparently thought the patient was mobile because they had fallen outside the house and were now inside, but the patient had actually been carried inside by a family member.

26 Reasons for why St John might have handled the case appropriately but the patient was still admitted to hospital after calling 111 include, there was no medical emergency requiring an ambulance, the information provided to St John was such that the advice provided to the caller was appropriate, the patient cancelled an ambulance dispatch, and the patient elected to self-transport rather than wait for an ambulance.

27 The reasons why a case may have been managed inappropriately, but that an ambulance should not necessarily have been dispatched included that the auditors felt that the patient should have been referred to seek medical treatment but was not, or they were referred to the wrong place to seek medical treatment, or with an inappropriate time-frame.
5.3.3 The clinical audit identified two adverse events during the first six months of the hub’s operation

For all 101 cases, auditors were asked “did this patient experience an adverse event?” Auditors were reminded that the Health Quality and Safety Commission (HQSC) define an adverse event as “an incident which results in harm to a consumer”.28

The reviewers agreed that two patients out of the 101 cases had suffered adverse events. We note that through the workshop process one case was inadvertently overlooked and has been categorised as ‘unclear’ as the auditors’ responses were split in the online survey. In both of the cases the auditors agreed that the delay in the patient attending ED after ringing 111 definitely contributed to the adverse event.

Table 7 - Adverse events identified through the clinical audit

<table>
<thead>
<tr>
<th>Adverse event – broken hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>In case 9, the patient had a broken hip. The lack of mobility was not recognised by the clinical hub and she was advised to take pain relief and see a doctor within six hours. An ambulance should have been sent. The patient’s temporary loss of function (minor adverse event) was made worse because she did not present at ED until the next day. This case had already been identified by St John as a non-compliant call. Auditors considered that this patient suffered a minor adverse event.29</td>
</tr>
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<table>
<thead>
<tr>
<th>Adverse event – abdominal pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>In case 29, an elderly patient with abdominal pain was referred to self-care. Two days later the patient presented at ED with a perforated appendix. The auditors’ view was that the given the age of the patient and the symptoms, she should have been transported to ED, or, at the very least referred to see a doctor within a short time. The two day delay contributed to the perforated appendix – a major adverse event.30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unclear if adverse event – fever and chest pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>In case 22, an elderly patient called with a fever and chest pain and pre-existing aplastic anaemia. The patient was advised to attend A&amp;M within two hours. It was unclear whether the patient did attend A&amp;M, but he did present at ED two days later with pneumonia and sepsis. Four auditors felt this case had not been appropriately managed, and the patient should have been referred straight to ED, or transported to ED, as an admission was very likely given the underlying condition and age. It was unclear the extent to which the delay contributed to the possible adverse event.</td>
</tr>
</tbody>
</table>


29 A minor adverse event is considered to be a ‘Permanent minor or temporary moderate loss of function that is related to the process of health care and differs from the expected outcome of that care.’

30 A major adverse event is considered to be a ‘Permanent major or temporary severe loss of function that is related to the process of health care and differs from the expected outcome of that care.’
5.3.4 Recommendations from the clinical audit

This section looks at four over-arching themes we drew out from the comments from the clinical reviewers and the workshop results. They are:

1. Specific assessment issues that St John should review.
2. Policy issues that St John should review.
3. Poor history recorded by the clinical hub.
4. Opportunities for service improvement that St John should explore.

Alongside each of the recommendations below we have documented St John’s response. As the clinical audit only reviewed cases during the first six months of the clinical hub’s operation, St John has been able to identify many of these issues and put in place changes that would address our concerns.

Specific assessment issues that St John should review

During the workshop, the auditors discussed a number of specific issues they had noted reoccurring during their review of the 101 cases, where they felt that the clinical hub was not responding appropriately. The following are specific issues that arose in a number of the cases where a patient was subsequently admitted to hospital:

- Abdominal pain not appropriately managed – mostly elderly (6 cases),
- Rigours in the elderly not appropriately managed (5),
- Falls – elderly (4),
- Unable to mobilise – not assessed properly (3),
- Falls from a height (3),
- Child in severe pain (3), and
- Elderly patient with co-morbidities referred to GP out of hours (3).

These conditions represent higher risks of hospital admissions and will have corresponding risks if the patient does not receive prompt medical attention.

**Recommendation:** We recommend that St John review the recommendations Odyssey makes in regard to each of these situations and assesses whether any additional training is required for staff in these areas.

*St John’s response:* The medical directors at HML and St John have reviewed the Odyssey guidelines for infants under 5 years old (July 2014) and falls assessments and outcomes (November 2014).

Policy issues that St John should review

No medical need for an ambulance, but concern about transport options

During the workshop, auditors discussed a number of cases where, although they agreed that there was no medical need for an ambulance, they were concerned about how the patient would transport themselves to ED, an A&M, or a GP. This theme was noted in 9 cases out of the 101 reviewed.
These cases tended to involve elderly and potentially frail patients. Auditors raised the question of whether St John should have a policy of establishing and documenting that vulnerable patients had a reasonable method of transport available before deciding not to send an ambulance.

**Language difficulties**
In one case, it was noted that language difficulties may have impeded communication.

**Recommendation:** If St John does not already have a clear policy for dealing with speakers of other languages, such a policy should be developed and staff trained in it.

*St John’s response – a contract with local Language Line services covering work hours and a contract has been finalised with a 24/7 international language translation service in March 2015.*

**Poor history recorded by the clinical hub**
In 16 of the 101 cases, auditors noted that the medical history taken by the clinical hub was poor. For example, patients were not asked about pre-existing conditions, assumptions were made about patients’ ability to mobilise, the length of time symptoms had persisted was not explored, or the mechanism of injury was not properly assessed.

We note that the auditors considered that the medical history taken by the clinical hub was poor in all three of the cases where an adverse event occurred or may have occurred.

**Recommendation:** St John should review these 16 cases, and assess whether the staff concerned, or hub staff generally, need additional training in taking accurate and effective medical histories.

*St John’s response: the clinical records provided to the auditors were incomplete as the data provided by HML were truncated so not all notes appeared in the records. All calls are recorded so that the nurse doesn’t have to type up a full history. Each nurse is audited at least one call per shift which forms part of a fortnightly coaching and review session with their Team Manager.*

**Opportunities for service improvement**
During the workshop and in their comments, the auditors identified a number of opportunities to improve the service provided by the clinical hub. These are each discussed below.

**Access to records**
At present, the clinical hub nurses/paramedics do not have access to existing patient records. In a number of cases, access to existing records would have helped the clinical hub staff understand the context and history of the patient and potentially provide more effective management of the case. For example, in one case a patient was in an end-of-life situation, and it would have been helpful for the hub nurse to understand any palliative care plan in place and tailor the management of the case accordingly. In other cases, understanding chronic conditions or recent events that might be relevant would assist the work of the clinical hub staff.
Ability to make referrals to a broader range of services

In some cases, auditors felt that there was a clear opportunity to refer the caller to an appropriate service, which might not only attend to the issue that prompted the call, but improve the longer-term situation of the caller and possibly prevent the need for future calls, medical attention, or hospital admissions.

Examples of this included instances where it would have been helpful for the clinical hub to refer callers to the falls pathway (for managing older people prone to falling); community alcohol and drug services; social services, or home support (in one case, auditors noted that a hospital admission was the trigger for properly setting up home support that could have prevented the admission if it had already been in place); or notifying GPs of the patient’s call and alerting them to the likely need for follow-up.

Auditors also noted that it would be useful for the clinical hub to have a list of subsidised A&M’s, if patients were concerned about cost.

**Recommendation:** We recommend that St John explore the ability to integrate more fully with the regional health system, including ways to access notes and provide referrals and notifications to a range of services.

*St John’s response:* A number of changes have been implemented over the last year which will go some way to addressing these issues such as training for staff on a number of alternative pathways and more detailed access to information on accident and medical clinics (including those who offer subsidised services). Clinical incident response determinants, primary options for acute care (POAC), district nurse and rapid response pathways have all been implemented.

Consideration of patient age and ethnicity

During the workshop, auditors made a range of comments about the usefulness of being alert to possible differences in how patients might represent their symptoms or situation, depending on age and ethnicity.

Auditors commented that certain ethnicities and age-groups tend to be more or less forthcoming about the extent of pain etc., and that this should perhaps be factored into their management (e.g., younger Asian patient very clear about pain levels, older Pacific and NZ European patients tend to be more reticent). These comments are generalisations, but the auditors considered that there could be value in ensuring that hub staff were aware of these potential differences so they could respond more appropriately.

*St John’s response:* St John’s have revised their ethnicity data capture to comply with Ministry of Health Level 3 and to support development of a Maori Health Strategy

5.4 A review of patient deaths found no concerns

Separate from the clinical audit, cases where a patient died within a short period after receiving telephone advice from the clinical hub were separately reviewed to assess the appropriateness of St John’s handling of the incident and to identify any adverse effects the clinical hub may have had on the patient.
We identified 3 patients who died in hospital within 7 days of receiving ‘hear and treat’ advice from St John after ringing 111. All 3 incidents (and 2 other incidents where patients died some time later) were reviewed.

The review concluded that all the patients that died shortly after receiving self-care advice had been provided adequate advice at the time of clinical hub call, especially in the context of their complex co-morbidities. The review concluded appropriate clinical processes were followed and the clinical outcome may have been a result of unmodifiable patient deterioration of pre-existing conditions.

31 As we were only able to match patients between St John and DHBs we could only identify those patients that subsequently died in a DHB facility. We cannot rule out that other patients may have died elsewhere (e.g. their own home) where we do not have visibility of their interaction with St John. St John advises that no other deaths have been brought to their attention through complaints from families or coroner reports.
6. The impact of the hub on St John

This section examines the impact of the clinical hub on St John, beyond the previously identified reduction in ambulance transports to ED.

We conclude that the clinical hub did not lead to any increase in 111 calls (a previously identified risk), that the hub freed up ambulance resources and contributed to overall improvements in ambulance response times, and that the clinical hub has enabled St John to better prioritise resources to dealing with urgent incidents. However, the refocusing of ambulance resources to urgent incidents has led to significant delays in ambulances arriving to the scene of less urgent incidents.

6.1 The impact of the clinical hub on incident volumes

A key issue for the evaluation is whether or not the clinical hub affected the volume of ambulance incidents St John handled in Auckland. At the outset of this evaluation we identified a possible risk with the clinical hub model - that the Auckland public may value receiving free clinical advice from triage nurses and therefore begin contacting St John whereas previously they would have otherwise have gone to their GP or contacted Healthline.

‘Induced demand’ for ambulance services is not inherently problematic, particularly if it is provides health services to patients who would otherwise not seek assistance. However, there would be clear risks if the clinical hub was displacing patients from a primary care setting – particularly if it was creating a second tier of health services for deprived patients or contributing to a lack of continuity of care.

6.1.1 There is no evidence the hub has induced demand for St John services

Our modelling demonstrates that it is extremely unlikely the clinical hub has affected the volume of emergency incidents St John dealt with during the period July 2014 to June 2015.

Our modelling projected that, if there had been no clinical hub, we would have expected St John to deal with 124,164 emergency ambulance incidents during the period July 2014 to June 2015 (up from 119,363 in 2013/14). During the relevant period St John actually dealt with 124,091 incidents – meaning it is statistically unlikely that clinical hub had any material impact on incident volumes.

The chart below compares our projection against actual incident volumes, with more information on the modelling available in Appendix 4.
The impact of the clinical hub on ambulance resources and response times

By providing clinical telephone advice to a group of 111 callers, St John has managed to improve outcomes for a much wider group of patients – those who require urgent ambulance attention and transportation to hospital.

The hub has reduced ambulance dispatches to non-urgent incidents, thereby freeing up ambulance resources in Auckland for more serious incidents and improving St John’s ability to reach the scene of priority events faster. However, ambulances now reach the scene of the least urgent incidents much slower than previously, as 111 callers are first required to interact with the clinical hub to determine whether an ambulance response is necessary.

The clinical hub has freed up ambulance resources

Compared to the rest of the country, Auckland has consistently had a higher proportion of emergency ambulance incidents where the patient requires ambulance transportation away from the scene. This means that an incident resulting in a 111 call is highly likely to result in an ambulance dispatch and subsequent transportation – taking that ambulance out of circulation for longer.

The following chart compares the transport rate in Auckland against the rest of the country. It demonstrates that the introduction of the clinical hub in the 2014/15 year caused a substantial drop in the proportion of EAS incidents requiring transportation – falling from 77.7% to 71.4% in 12 months.
The implication of this change is important: with an incident now considerably less likely to result in a subsequent ambulance dispatch and transportation, ambulance resources are being freed up.

Transporting a patient can take an ambulance out of circulation for a considerable period of time; thereby putting pressure on St John’s ability to respond promptly to other incidents and potentially delaying treatment for patients who urgently need care. With an average job cycle for an Auckland ambulance transport of 74 minutes (from allocation to clearing the treatment centre), we estimate that over the course of the 12 month proof-of-concept period, the clinical hub freed up 6,620 hours of ambulance resources – the equivalent of having an additional ambulance available fulltime for 276 days of the year.

6.2.2 St John has improved response times across Auckland for serious incidents

During the 12 months of the clinical hub proof-of-concept, Auckland had the biggest improvements in both urban and rural response times for serious incidents across St John’s 12 Districts.

During the 12 months to June 2015:

- **Auckland urban responses**: the proportion of ‘purple’ and ‘red’ incidents responded to within 8 minutes improved from 46.8% to 52.6% (compared to a 2.6% national average increase), and

- **Auckland rural responses**: the proportion of ‘purple’ and ‘red’ incidents responded to within 12 minutes improved from 39.7% to 46% (compared to a 1.2% national average increase).

There are likely to be many contributing factors for these improved response times in Auckland, including the introduction of new frontline staff and ambulances over the 12 month period. However, based on our earlier findings that St John ambulances are
responding to (and transporting) fewer lower acuity incidents in Auckland, we consider the clinical hub would have been a material contributing factor to the improved response times.

This is an important finding for the evaluation – even if the clinical hub does not interact with a patient the hub is likely still having an impact by freeing up St John ambulances to respond faster to serious incidents.

6.2.3 The clinical hub has led to significant delays in ambulance arrivals at less urgent incidents

Although there has been an improvement in response times for urgent 111 calls, it is likely this has come as a result of ambulances being reprioritised away from less urgent calls.

Table 8 below shows the median period of time it took an ambulance to arrive on the scene from the time when the 111 call handler answered the telephone. It shows that, for those incidents where an ambulance was eventually dispatched, there were some material increases in response times for 111 calls initially classified as ‘green’ and ‘grey’ during the period of the hub’s operation.

Table 8 – Median period of time from initial 111 call being answered to ambulance arrival on scene

<table>
<thead>
<tr>
<th>Initial 111 call triage</th>
<th>Year to June 2014</th>
<th>Year to June 2015</th>
<th>Change during the clinical hub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>7min 54sec</td>
<td>7min 46sec</td>
<td>-8sec</td>
</tr>
<tr>
<td>Red</td>
<td>10min 5sec</td>
<td>9min 49sec</td>
<td>-16sec</td>
</tr>
<tr>
<td>Orange</td>
<td>17min 11sec</td>
<td>16min 27sec</td>
<td>-44sec</td>
</tr>
<tr>
<td>Green</td>
<td>23min 32sec</td>
<td>29min 18sec</td>
<td>+5min 46sec</td>
</tr>
<tr>
<td>Grey</td>
<td>27min 32sec</td>
<td>38min 57sec</td>
<td>+11min 25sec</td>
</tr>
</tbody>
</table>

A delay in ambulance arrivals to the scene of ‘grey’/‘green’ triaged incidents is to be expected and is indeed a feature of the clinical hub operating model. During the year to June 2015 ‘grey’ and ‘green’ incidents were no longer automatically added to the queue for ambulance dispatch; instead, callers were required to go through the clinical hub prior to any ambulance being dispatched. The delay in ambulance arrival for these incidents in 2014/2015 reflects the time spent awaiting a clinical hub assessment that eventually determined an ambulance was necessary: including both the time prior to the hub nurse making contact with the patient and the duration of the secondary triaging.32

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32 Ambulance response times from the point of ambulance mobilisation are very similar for green/grey incidents from 2013/14 to 2014/15, confirming that the delay identified above from the point of the initial 111 call is attributable to the clinical hub.
This delay reflects that secondary triaging of certain ‘grey’/’green’ incidents was not successful. Instead of an ambulance being immediately dispatched upon the conclusion of the 111 call (as might have previously occurred), the caller has taken part in secondary triaging that has delayed ambulance dispatch and arrival and has ultimately added minimal value for those patients. As we examine in section 9.1.2, some of these 111 callers risk being adversely affected by these delays.

In our view, freeing up ambulance resources to attend more urgent incidents is a desirable outcome of the clinical hub. However, the current delays in ambulance attendance at less urgent incidents is somewhat concerning when one considers that 65% of incidents handled by the clinical hub still required an ambulance to be dispatched.

Over time we would expect the accuracy of the hub triaging processes to improve. The characteristics of those incidents not being successfully resolved through ‘hear and treat’ will be identified and excluded from the clinical hub in the future. We expect St John to continue to invest in improving the rate of ‘hear and treat’ resolution, which will reduce the delays associated with ambulance arrivals at less urgent incidents.

6.2.4 The clinical hub may also help in responding to frequent callers

It would also appear that the clinical hub has provided an additional tool for St John to manage those patients who frequently call 111 for ambulance services. Ambulance services typically have a core group of users whose medical condition means they request continued support or who see St John as a ‘first port of call’ when considering assistance. These users can consume considerable ambulance resources and there are considerable benefits if they can be proactively managed or, where possible, redirected to more appropriate forms of care.

There was a material reduction in ambulance call-outs to repeat patients in 2014/15, with ambulance attendances to repeat individuals (i.e. excluding rest homes etc.) down 5.1% on the year prior. This significantly exceeds the overall reduction in the same period in ambulance call-outs of 3.4%. More importantly, this reduction in call-outs disproportionately occurred within the ‘grey’/’green’ triage categories, which were handled through the clinical hub (dispatches to repeat individuals for ‘grey’/’green’ incidents decreased by 46% in the year).

The reduction in ambulance dispatches to repeat patients is also pronounced amongst the top 100 individual users of ambulances in Auckland, with ambulance attendances down 28% amongst this group for the year:

- In 2013/14, 100 individuals were responsible for 2,440 ambulance attendances (2.14% of ambulance attendances)
- In 2014/15, the same 100 individuals were responsible for 1,761 ambulance attendances (1.60%) of ambulance attendances.

The clinical hub alone will not be responsible for freeing up of ambulance resources from dealing with repeat patients, as St John has also been introducing patient management plans to help manage demand from frequent users for some time. However, in our opinion, the clinical hub’s ability to redirect less urgent ‘grey’/’green’ incidents from frequent users almost certainly provided another useful means by which ambulance resources could be freed up to deal with more urgent incidents.
6.3 The impact of the clinical hub on transports

We noted in the previous section that the clinical hub has resulted in a material decrease in ambulance transports to ED. This primary outcome from the clinical hub intervention has had a number of secondary impacts on St John transport activity, which we discuss below.

6.3.1 The hub has enabled St John to refocus transportation activity to urgent incidents

Our analysis has confirmed that the clinical hub enabled St John to better target its transportation activity to more urgent incidents.

The chart below shows St John transports, broken down by proportion that each initial triage code comprises of total transports. As with our modelling on ED transports, it appears the hub took several months to have a material impact on St John activity, but by December 2014 the impact is clearly visible: urgent incidents comprise a much higher proportion of St John’s transportation activity while the clinical hub is operational.

Comparing a snapshot of June 2014 against June 2015 shows how the nature of ambulance transports have changed in Auckland as a result of the clinical hub intervention:

- **Grey triaged incidents** (not serious or life-threatening): comprised 8.8% of all St John transports in June 2014, but comprised only 0.9% of transports in June 2015
- **Red** (immediately life threatening or time-critical): increased from 47.3% of all transports to 51.2%.
- **Orange** (urgent / potentially serious): increased from 24.4% to 29.0%.
The volumes of ‘purple’ and ‘green’ incidents appear to be relatively consistent with historic proportions.

6.3.2 The impact of the hub on transport volumes appears to be uniform across Auckland

As we observed in the preceding chapter, following the intervention of the clinical hub ambulance transports to EDs in Auckland were 5.9% lower than they otherwise would have been (and 4.6% lower than volumes in preceding 12 months). The map below shows the percentage change in ED transports when comparing the transports made during the operation of the hub with those in the preceding year (excluding those localities with low absolute transport volumes).

Figure 8 - Map of changes in ED transports from the preceding year

It is difficult to draw any firm conclusions from the above chart, except to note that the decline in transports appears to be relatively uniformly spread across the Auckland region.

The North Shore is one area where the clinical hub is likely to have had an unusually high impact on reducing ED transports. Transports originating on the North Shore fell by 10.0% (447) during the period the clinical hub was operating compared to the preceding year, much higher than the average Auckland reduction of 4.6%.
Other localities that appear to be outliers have relatively small population bases, so we cannot rule out that the changes from the preceding year were instead driven by changes in the underlying population in that area:

- Wellsford: transports were down 16.1% (74) on the preceding year,
- Waiheke Island: transports were down 8.1% (62) on the preceding year, and
- Helensville: transports were up 13.1% (111) on the preceding year.

More detailed analysis on the origin of ambulance transports is contained in Appendix 5.

6.3.3  The clinical hub is having a material impact on St John’s transports during the weekend

As was shown in Section 3.3.2, the clinical hub was busiest during the weekend; however, this it does not necessarily follow that the biggest reduction in ED transports would have been on the weekend.

The following chart highlights the minimal variation in St John transports to ED by day of the week, with each day accounting for between 13.8% and 14.8% of an average week’s transport volumes. Consistent with historic trends, Monday remains the busiest day for Auckland transports in the year to June 2015 (and is typically the busiest for GPs and EDs), while Saturday and Sunday appear to have comparatively fewer transports, particularly following the introduction of the clinical hub. The degree of historic volatility as to the days of the week for transports means we should be cautious into reading into why transport volumes did not fall as much on Tuesdays as other days.

![Chart showing St John ED transports by day of the week](chart)

The following chart highlights the degree to which ambulance transport volumes for each day of the week for the year to June 2015 were lower than volumes the preceding year, compared

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33 The two busiest hours for St John for transports are from 10am-12pm on Monday mornings.
to the overall reduction of 4.6%. Commensurate with the weekend being the busiest period for the clinical hub, transport volumes had statistically significant reductions on Saturdays (down 6.5%) and Sundays (down 5.6%); with Mondays (down 5.7%) and Thursdays (down 6.4%) also experiencing large reductions.

![Percentage reduction in ED transports, year to June 2015 (compared to previous year)](image)

The fact that St John transports have experienced significant reductions on Saturdays/Sundays/Mondays is insightful. These are typically the days of the week when there are more likely to be barriers to patients accessing primary care services in a timely manner: practices are often closed during the weekend, while Monday is usually the busiest day for practices. We can hypothesise that, upon a health issue arising and a patient being unable to promptly see their usual GP, some patients might see St John as an alternative source of care. The fact that the hub is reducing St John transports on those days is an indicator that the hub may be having an impact identifying lower acuity patients and providing self-care advice or advising that they can safely wait and see their clinician.

More detailed modelling on transports by day of the week is available in Appendix 6.

### 6.3.4 There is no clear hour of the day trend

We have previously observed that the hub has a fairly consistent caseload from 10am through to 9pm and that there may be opportunities to better match hub capacity with peak periods of St John activity. An analysis of how St John’s transportation activity has changed throughout the day confirms that the clinical hub has had no material impact on when St John transports patients – with some slight variation, the profile of transport activity by hour of the day remains relatively constant. As we observed in our evaluation framework, the relative proportion of St John transports to ED when broken down by hour of the day has remained consistent for many years.
The following chart shows the reduction in ED transports for the year to June 2015 (compared to the previous year), broken down by hour of the day.
Our observations from this data are that:

- With some variation, the greatest impact on ambulance transports to ED appears to have occurred during the period 10am to 5pm (corresponding with the period when St John is typically busiest and when the hub was handling the most calls);
- The hub has had minimal impact on transport volumes from midnight to 5am. Compared to the 12 months prior, over these 5 hours ED transport volumes were only down by 269 over the 12 month operation of the hub (with an average of only 0.7 fewer transports per day in this time slot across all of Auckland).

We conclude there is a case for reviewing the resourcing of the clinical hub.

**Recommendation:** St John to review the case for moving away from a 24/7 clinical hub service and instead provide extra staffing during periods of peak volume. The clinical hub was not particularly busy (and had less of an impact on ambulance transports) between midnight and 5am; while the hub’s activity did not increase commensurably during the busiest period for St John (10am to 2pm).
7. The impact of the hub on secondary care services

This section examines the impact the clinical hub had on secondary services during the 12 months to June 2015. We conclude the clinical hub caused a significant reduction in ED presentations in Auckland and, in our opinion, also likely reduced hospital admissions.

7.1 Measuring the impact on EDs

7.1.1 The clinical hub had a significant impact on the volume of patients presenting to ED

In Section 4, we concluded that the clinical hub reduced ambulance transports to ED by 5,369 during the period July 2014 to June 2015. However, this overstates the impact of the hub on reducing ED presentations – as it will not capture those individuals who receive phone advice from the St John clinical hub and make their own way to ED. If a caller makes their own way to ED then the St John clinical hub may have resulted in one fewer ambulance transport, but it cannot be said to have resulted in one fewer ED presentation.

Methodology

As outlined in the evaluation framework, the impact of the clinical hub on ED attendances can be measured by:

\[
\text{A reduction in ED presentations } = \text{ the reduction in ambulance transports to ED (sourced from section 3 above) minus any increase in hub ‘users’ self-presenting to ED}
\]

We consider the clinical hub to have successfully ‘avoided’ an ED presentation if a caller to the clinical hub does not present to ED about the same issue within 24 hours of contact with St John.34 Table 9 below shows that that, of those clinical hub users who self-presented to ED, the overwhelming majority did so promptly – with 90% self-presenting within 24 hours of receiving ‘hear and treat’ advice.

---

34 We do not have data on whether patients are presenting to ED with the same condition that prompted them to call 111. We consider their presentation to ED within 24 hours is a reasonable proxy for assuming that they are presenting with the same condition.
Table 9 - Period of time before hub users self-present to ED following interaction with the clinical hub

<table>
<thead>
<tr>
<th>Period of time before presenting to ED</th>
<th>Proportion of all hub users self-presenting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-presents to ED within 24 hours</td>
<td>90%</td>
</tr>
<tr>
<td>Self-presents to ED between 24 – 48 hours</td>
<td>7%</td>
</tr>
<tr>
<td>Self-presents to ED between 2 - 7 days</td>
<td>3%</td>
</tr>
</tbody>
</table>

Identifying volume of hub users likely to be self-presenting to ED

We can identify hub users who subsequently attended an Auckland ED by matching data held by St John and the Auckland DHBs. The clinical hub captured NHI data for 73.9% of patients, which enables us to cross-check with DHB records whether the patient made their own way to ED (the success rate was 73.6% for those callers who received ‘hear and treat’).

The following are our conclusions on the volume of hub users who are likely to have self-presented to ED after receiving ‘hear and treat’ advice from the clinical hub:

- 730 patients are known to have presented to ED after receiving clinical telephone advice from the clinical hub and for whom no ambulance had been dispatched. 655 of these patients self-presented to ED within 24 hours of ringing 111.

- However, the actual number of clinical hub users self-presenting to ED will be higher:
  - DHB records provided for this evaluation were incomplete, with only 84.2% of known ED presentations having patient record-level data available. We therefore propose to scale up our estimate of the number of hub users (with NHI) who are likely presented to ED within 24 hours to 778, to reflect the likely numbers we would have identified if we had full DHB datasets.
  - We have had to make some assumptions about the outcomes for ‘hear and treat’ clinical hub users for whom NHIs were unknown, meaning it was not possible to determine whether they actually presented to ED:
    - we have assumed all patients who agreed with the clinical hub advice to promptly make their own way to ED subsequently presented to ED within 24 hours, and
    - we have assumed that the remaining population group for whom no NHIs was known presented to ED at the same rate as the population group for whom NHIs were known.

35 DHB decision support teams in Auckland advised that they recorded 382,273 consults in Auckland in 2014/15, while the Ministry of Health and DHB NNPAC record exchange for this evaluation (described in Appendix 3) had 60,277 fewer ED presentation records, representing 15.7% of total known ED presentations. Despite considerable time spent on this matter by Sapere, St John and the three Auckland DHBs, we have been unable to improve the quality of the ED data records.

36 We have no reason to conclude that amongst those receiving ‘hear and treat’ advice the ability to identify an NHI for a caller in any way reflects their propensity to self-present to ED.
This calculation is represented in Table 10 below.

**Table 10 - Estimate of self-presentations to ED amongst 'hear and treat' callers**

<table>
<thead>
<tr>
<th></th>
<th>Self-present to ED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ‘hear and treat’ incidents</td>
<td>8,499</td>
</tr>
<tr>
<td>‘Hear and treat’ incidents with known NHI (73.6%)</td>
<td>6,258</td>
</tr>
<tr>
<td>Callers with known NHI who self-presented to ED</td>
<td></td>
</tr>
<tr>
<td>[known presentations of 655 scaled up to reflect DHB data gap]</td>
<td>778</td>
</tr>
<tr>
<td>‘Hear and treat’ incidents with no known NHI (26.4%)</td>
<td>2,241</td>
</tr>
<tr>
<td>Assume all callers with no known NHI who are advised to</td>
<td>242</td>
</tr>
<tr>
<td>promptly make own way to ED go to ED</td>
<td></td>
</tr>
<tr>
<td>Assume remaining population group with no known NHI self-present</td>
<td>= (2,241-242) * 5.1%</td>
</tr>
<tr>
<td>to ED at same rate as group with known NHI (where advice is</td>
<td>101</td>
</tr>
<tr>
<td>other than to go to ED)</td>
<td></td>
</tr>
<tr>
<td>**Estimate of self-presentations to ED amongst ‘hear and treat’</td>
<td>1,121</td>
</tr>
<tr>
<td>callers**</td>
<td></td>
</tr>
</tbody>
</table>

Our best estimate is that 1,121 of the 8,499 patients receiving ‘hear and treat’ advice from the clinical hub subsequently self-presented to ED (13.2% self-presentation rate). We have not been able to determine whether the patients presented with the same condition that prompted them to call 111, but consider it highly likely that the vast majority did, given the ED presentation was within 24 hours of the 111 call.

**Estimate of the impact of the clinical hub on ED demand**

Taking into account the estimated reduction in ambulance transports (5,369) and the estimated increase in self-presentations to ED (1,121), our best estimate is the clinical hub resulted in **4,248 fewer ED presentations** during the period July 2014 to June 2015. This represents a 1.1% reduction in total ED presentations across the five Auckland EDs for the year.

Although this is our best estimate of the likely impact of the clinical hub on reducing demand for ED services, we have been unable to determine whether the clinical hub may simply be delaying (rather than preventing) the attendance of some patients in secondary care. For example, we cannot rule out that there are some patients who received self-care advice from the clinical hub and presented to ED many months later with more complex conditions. DHB and St John staff who we discussed this issue with were unaware of any means of comprehensively identifying such patients and, to date, had not been made aware of any such concerns by ED clinical staff or GPs about delayed treatment.
7.1.2 We cannot determine how the clinical hub may have affected the nature of ED presentations

We cannot conclusively say what impact the hub may have had on the nature of the cases being seen in Auckland EDs, with the reduction in ED presentations representing only 1.1% of all ED presentations.

We observe patients being assessed at Auckland EDs upon presentation as being ‘triage level 5’37 (the lowest triage level) fell from 4.1% to 3.4% of all presentations when comparing 2014/15 against the preceding year. However, we cannot be sure of the cause of this reduction.

We would be reluctant to attribute this change solely to the existence of the clinical hub. However, it is possible the St John clinical hub contributed to the decline in the proportion of lower acuity incidents presenting to Auckland EDs. With St John transporting fewer low acuity incidents to EDs, the Auckland EDs may have seen the impact through a slight re-orientation of their case-mix towards treatment of more serious cases. Certainly, we are more confident the introduction of the clinical hub did not increase ED presentations.

7.1.3 Clinical hub users are self-presenting to ED with less urgent conditions than the general population

Importantly, 111 callers who received ‘hear and treat’ advice from St John and then self-presented to ED were assessed by ED clinicians as having less serious conditions than the general ED population.

The chart below compares the ED triage levels for those patients who received ‘hear and treat’ advice against all ED patients.

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37 Defined as ‘less urgent, or dealing with administrative issues only’.
The implication is that there is a group of 111 callers who, as an aggregate, do not have sufficiently urgent conditions that would justify ambulance transportation to ED simply because they rang 111. There is likely to be an important ongoing role for the clinical hub in re-assessing the need for ambulance responses to 111 calls and advising callers when they can safely make their own way to ED.

7.2 Measuring the impact on inpatient services

Although a key purpose of the clinical hub is to reduce unnecessary transportations to ED, the clinical hub is also likely to reduce hospital admissions as a result of there being fewer ED presentations.

7.2.1 In our opinion it is highly likely the clinical hub contributed to a reduction in hospital admissions

It is not possible to definitively measure the impact that the clinical hub might have had on hospital admissions in Auckland. However, it is our conclusion that, by reducing the volume of patients presenting to ED, the clinical hub would also have reduced the volume of patients being admitted to Auckland hospitals.

38 The DHBs have been unable to provide a robust time series data needed to track inpatient volumes over time, broken down by those who are admitted from ED following an ambulance transportation.
The greatest impact of the clinical hub will be from keeping patients out of ED rather than keeping them out of hospital. However, of those patients that St John will no longer transport to ED, it is reasonable to assume that a small proportion would otherwise have been transported to ED and then subsequently admitted to hospital as an inpatient.

As observed above, our best estimate is that the clinical hub prevented approximately 4,248 patients presenting at Auckland EDs for the 12 months to June 2015. Amongst this group would have been patients who, if they had presented to ED, would have been admitted to hospital. This category of patients is likely to include those more fragile/older patients that were supported through the hub,39 those patients where a paramedic received advice from the hub to assist in stabilising the patient at their home, and those patients where the hub facilitated earlier contact between the patient and primary care than would typically occur.

Our view is that St John’s new service model will successfully keep the lowest-acuity patients from ED – and thereby have a minimal impact on hospital admissions. Of those patients who will no longer be transported to ED, we consider a reasonable (and likely conservative) estimate is 5-10% would otherwise have been admitted to hospital as inpatients.40 This would mean that the clinical hub was likely responsible for **212 to 425 fewer hospital admissions** across Auckland during the period July 2014 to June 2015.

39 So called ‘social admissions’ to hospital are known to often occur when elderly patients arrive to ED during the night or when they may have difficulty arranging return transport from ED.

40 We consider the admission rate for those patients the clinical hub successfully kept out of ED would have been much lower than the general population (our previous work for St John identified that approximately 31% of ED presentations result in a hospital admission). Sapere’s 2013 evaluations of the St John and Wellington Free Ambulance ‘Urgent Community Care’ pilots identified that the interventions likely resulted in fewer inpatient admissions, but that we could not identify any statistically significant impact on admission rates.
8. The impact of the hub on primary care

This section examines the impact that the clinical hub has had on demand for primary care services and explores whether the clinical hub has simply redirected 111 callers into primary care.

We conclude that the clinical hub has almost certainly led to an increase in primary care consultations, albeit the volumes would have been immaterial at the level of the individual practice. Our interviews with primary care clinicians in Auckland indicated a high level of support for the intent of the clinical hub and efforts to ensure patients can be seen in primary care when appropriate.

8.1 The clinical hub likely had a small, non-identifiable, impact on primary care volumes

We consider it likely that St John clinical hub resulted in a small increase in primary care consultations during the 12 month pilot.

Our estimate of the maximum potential impact that the clinical hub could have on additional demand for primary care is 8,022 more consultations over the 12 month period (an average of 22 per day across Auckland), representing 0.2% of primary care activity in Auckland. We believe the actual impact is much less than this.

The clinical hub would have increased demand for primary care services

We have not been able to conclusively measure the impact the hub has had on volumes of patients being seen in primary care. There is no historic data on 111 callers presenting in primary care and nor has it proven possible to examine comprehensive data sets on primary care consultations across Auckland during the operation of the hub to identify any recent changes in volumes. Nevertheless, we have been able to infer that the clinical hub likely led to more patients being seen in primary care, albeit at volumes that would not have had a material impact on primary care services.

We make this finding by examining the maximum number of patients that the clinical hub could have displaced into primary care, as follows:

- the clinical hub handled 24,388 incidents,
- from this group, we know that 15,889 incidents had ambulances dispatched to the scene, from which:
  - 11,012 patients were transported to ED/hospital. The clinical hub would not have affected primary care consultations amongst this group, given their treatment in ED would have mirrored what would have occurred without the hub,
4,877 patients were either treated at the scene by an ambulance officer or were transported to a non-ED destination (e.g. A&M or general practice). For the purpose of determining the maximum impact the hub might have had on primary care demand, we have assumed that all 4,877 patients may have subsequently presented in primary care.

• Of the 8,499 patients interacting with the clinical hub but for whom no ambulance was dispatched, we can reasonably estimate that 3,145 patients would have presented in primary care. This calculation is based on the survey of hub users, which found 37% of those patients for whom an ambulance was not dispatched subsequently sought care from a primary care provider.41

Using these assumptions we estimate there is an upper bound of 8,022 new patients presenting in primary care. If we further assume that, in the absence of the clinical hub, none of these patients would have otherwise seen their GP about the condition that prompted them to call 111 then the clinical hub would have increased demand for primary care consultations in Auckland by approximately a 0.2%.42

This potential increase in demand for primary care services of 0.2% is based on a number of conservative assumptions (outlined above) in order to calculate the maximum possible impact the hub might have had on primary care services. In our opinion the true impact would be considerably less than this upper bound, as not all of these patients’ attendances at primary care would be attributable to the clinical hub.

Any impact on demand would be immaterial at the individual practice level

The impact of the clinical hub would have been immaterial and unobservable at the individual practice level. The upper bound of 8,022 new patients in primary care represents an additional 22 additional consultations per day across Auckland. This increase in demand would be unobservable amongst the 550 GP practices/A&Ms in Auckland.43

As part of the evaluation we interviewed staff from five of the largest A&Ms in metro Auckland. There was a relatively high degree of awareness that St John had implemented nurse-triaging for some 111 callers, but no-one had noticed any increase in demand that they could attribute to the clinical hub.

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41 27% saw their GP and 10% visited an after-hours centre.

42 According to the Ministry of Health there were 12.4m GP consultations in New Zealand in 2013 (http://www.health.govt.nz/nz-health-statistics/health-statistics-and-data-sets/primary-care-data-and-stats). If we assume there are similar volumes for the country in 2014/15 and that Auckland’s share of these consultations is approximately the same as its population (33% of New Zealand), then Auckland would have had approximately 4.15m GP consults during the period of the hub proof-of-concept.

43 Sourced from Healthpoint.
8.2 St John continues to transport patients to non-ED destinations

A key objective of the hub was not just to resolve low-acuity calls over the phone, but to provide on-road support to attending ambulance officers including, if necessary, advice on alternative care arrangements.

St John continued its trend of increasing the proportion of its ambulance transports that go to non-ED destinations. The chart below shows that, compared to the preceding year, St John transported approximately the same volume of patients to non-ED destinations (3,285 compared to 3,295 in the preceding year). This volume represented a slight increase in the share of transports going to non-ED destinations (3.8% of all transports compared to 3.6% in the preceding year).

This finding is material. With St John resolving many less urgent incidents over the telephone, we had hypothesised there would be a significant reduction in ambulance transports to non-ED destinations, as incidents not serious to warrant a transport to ED would be the very type of case being addressed by the clinical hub. Instead there was practically no reduction in transports to non-ED destinations. This is another indicator that the clinical hub has been highly successful in reducing transports to ED.

The following table shows transport volumes to the top 10 non-ED destinations. There has been virtually no change in their relative rankings. The levelling off of volumes has been fairly consistently spread, with the exception of Pukekohe Family Health Centre (down 21% on the preceding year’s volumes) and Shorecare Smales Farm (up 13%).
Table 11 - St John transports to non-ED destinations (top 10 destinations)

<table>
<thead>
<tr>
<th>St John transports to non-ED destination</th>
<th>Year to June 2014 transport volume</th>
<th>Year to June 2015 transport volume</th>
<th>Percentage change, year to June 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pukekohe Family Health Centre, West St</td>
<td>317</td>
<td>252</td>
<td>-21%</td>
</tr>
<tr>
<td>Shorecare Smales Farm</td>
<td>217</td>
<td>245</td>
<td>13%</td>
</tr>
<tr>
<td>East Care Super Clinic</td>
<td>170</td>
<td>177</td>
<td>4%</td>
</tr>
<tr>
<td>White Cross Ascot</td>
<td>146</td>
<td>144</td>
<td>-1%</td>
</tr>
<tr>
<td>Takanini Care</td>
<td>142</td>
<td>144</td>
<td>1%</td>
</tr>
<tr>
<td>Counties Care Medical Centre</td>
<td>135</td>
<td>118</td>
<td>-13%</td>
</tr>
<tr>
<td>Westcare Whitecross, New Lynn</td>
<td>114</td>
<td>118</td>
<td>4%</td>
</tr>
<tr>
<td>Coastcare Accident &amp; Medical Centre</td>
<td>105</td>
<td>110</td>
<td>5%</td>
</tr>
<tr>
<td>Westcare Whitecross, Lincoln Rd</td>
<td>124</td>
<td>107</td>
<td>-14%</td>
</tr>
<tr>
<td>Matiatia Wharf (Waiheke island)</td>
<td>62</td>
<td>75</td>
<td>21%</td>
</tr>
</tbody>
</table>

8.3 Primary care views are supportive of the intent of the clinical hub

As part of the evaluation seven of the largest Accident and Medical providers in metro Auckland were contacted. Five of those seven agreed to provide feedback to Sapere on the hub. From those five, we interviewed clinical directors or nurse managers, most of whom were aware of the clinical hub pilot to varying degrees:

- None of the interviewees had any concerns around the purpose of the clinical hub and the processes that were being used to redirect lower acuity patients. They felt that if patients were triaged as appropriate to be seen in primary care then that was where they should be directed.
- All interviewees advised it was difficult to know the impact of the clinical hub as the only way they knew if a patient had interacted with the clinical hub was if the patient advised them they had been redirected to primary care after calling 111.
- One Clinical Director advised that he had encountered some patients who had been directed to primary care after calling an ambulance and speaking with a nurse. He advised that patients were happy with the service and that the outcomes seemed entirely appropriate for the patients he had seen.
9. **The impact of the hub on patients**

This section examines the impact the clinical hub had on 111 callers during the 12 months to June 2015.

We conclude that the benefits of the clinical hub are much broader than just those patients who receive ‘hear and treat’ advice and are redirected to more appropriate levels of care for their condition. The hub also benefits patients that are eventually transported to ED by providing an important opportunity to re-triage and prioritise their incident, while all 111 callers benefit from the improved ambulance resourcing and response times attributable to the hub. The survey undertaken of hub users also demonstrates that that clinical hub is delivering a valuable and well-received service to 111 callers.

However, in situations where an ambulance is ultimately needed, the intervention of the clinical hub has led to material delays in ambulances attending less urgent incidents. While this is of some concern given 65% of incidents handled by the clinical hub require an ambulance to be dispatched, we would expect this to be less of an issue over time as St John continues to invest in improving the ‘hear and treat’ resolution rate of the clinical hub.

### 9.1 The clinical hub benefits most 111 callers

This section examines the impact of the clinical hub on three categories of 111 callers:

- clinical hub users who receive ‘hear and treat’ advice,
- clinical hub users for whom an ambulance is dispatched, and
- 111 callers who do not interact with the clinical hub

#### 9.1.1 Hub users benefit by receiving an appropriate level of care

A key objective of the clinical hub is to improve patient health outcomes by connecting patients to the right care, at the right time and in the right place. In essence this means delivering the lowest safe level of care, as appropriate to the clinical needs of the 111 caller.

Ambulance services and EDs are designed to provide episodic care and there are clear risks if patients are seen by ambulance services in circumstances when their condition is something that should be seen in primary care setting. Redirecting patients with lower acuity conditions into primary care should lead to greater continuity of care, help improve the management of chronic conditions, enable more tailored preventative care measures to be put in place, and will support patients by connecting them with other health and social services in their community.

As observed in section 8.3, the five Auckland primary care clinicians we interviewed all supported the intent of identifying less urgent conditions that could be seen in a primary care setting.
A lack of direct referrals and follow-ups may heighten risks to patients

A risk of providing clinical telephone advice to 111 callers is that the caller does not follow the plan agreed with the clinical hub – thereby leading to worse outcomes for the patient than if an ambulance had dispatched. There is evidence some patients receiving telephone advice may not have followed the plan agreed with St John clinical hub staff:

- the survey of clinical hub users shows 18% of respondents acknowledged they did not follow the care plan agreed with the clinical hub, and
- the survey shows 37% of clinical hub users visited a GP or A&M after interacting with the clinical hub; although the clinical hub advised 53% of hub users to do so.

There may be some risks from having a relatively large proportion of 111 callers self-manage their conditions after being advised by St John to seek medical attention.

We note that a number of ambulance services overseas have systems in place to enable them to directly link patients with relevant healthcare providers. As described by the University of New South Wales:

> ‘Ambulance Victoria has agreements with health providers that specify minimum response times for referred calls. In fact, the Nurse-on-Call non-emergency telephone triage line in Victoria, Australia, is not used for secondary ambulance triage precisely because it is not able to provide formal referrals or appointments for health services. In England and Wales, NHS Direct, which provides secondary ambulance triage to some ambulance services, has a linked directory of local health services so that a caller can be referred to a specific provider.’

St John advises that the clinical hub does make GP appointments for some patients, although it largely occurs on an ad hoc basis. There is a protocol that, if a patient needs care within 2 hours, then the hub nurse must offer to call a GP and make an appointment, then make the appointment before calling the patient back to confirm.

St John hopes to streamline the process by enabling the clinical hub staff to electronically make appointments for callers in the future. We think it would be worthwhile taking a first-principles review of how the clinical hub can most effectively and efficiently facilitate contact between patients and primary care services – without overloading the clinical hub staff with administrative workload.

**Recommendation:** St John to develop a business case that examines the costs and benefits for better linking 111 callers to healthcare services, including options for hub staff directly making GP appointments, providing callers with information on nearby clinics (and fees), transferring callers to primary care, and contracting for follow-ups.

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44 Centre for Health Systems and Safety Research, ‘Secondary ambulance triage service models and outcomes: a review of the evidence’ (2012), University of New South Wales
It is unlikely patients are facing significant additional costs

As a result of the clinical hub, some patients will now incur additional costs from having to make their own travel arrangements to seek healthcare as well as facing fees for seeing their GP or other healthcare provider.

However, for the majority of patients any new costs will be outweighed by the savings from not having to pay a part charge fee to St John for call-outs to medical incidents (approximately 80% of ambulance incidents are medical rather than an accident emergencies, meaning most patients would face an $88 ambulance call-out fee45). While a small proportion of patients will likely be slightly worse off financially as a result of the clinical hub, our view is this would be outweighed from the benefits to that group of patients. Those patients have conditions that do not require ambulance and ED level of care and it is appropriate that they are managed in a primary care setting. The level of additional costs for primary care treatment is unlikely to be a material barrier to healthcare for these patients.46

9.1.2 The value of the clinical hub is questionable in situations where an ambulance is ultimately needed

Although the value of the clinical hub is relatively clear in cases of successful ‘hear and treat’, its value is less apparent for those incidents where the clinical hub was unable to resolve the incident over the telephone.

Unsuccessful ‘hear and treat’ can inject considerable delay into ambulance arrival on scene

Over the course of the 12 month proof-of-concept period there were 15,889 clinical hub incidents where an ambulance was ultimately dispatched to the scene (65% of all hub incidents). This relatively low resolution rate will give rise to concern over the medium term as the intervention of the clinical hub clearly injects considerable delay into the timeframe in which an ambulance would otherwise have attended the scene.

We observed above in section 6.2.3 that the time for an ambulance arrival on scene was delayed, on average, for all ‘grey’ and ‘green’ incidents across all St John incidents in Auckland during the year 2014/15. When we examine the delay for only those ‘green’/’grey’ incidents that were went through the clinical hub, we can observe that the delay in ambulance attendance is even more pronounced. The following table compares the median period of time for ‘grey’/’green’ incidents from the initial 111 call being answered until the arrival of an EAS ambulance on scene:

45 In 5% of all ‘hear and treat’ incidents the caller was a member of the St John Supporter Scheme and so would not have faced an ambulance call-out fee. These 5% of callers will now face additional costs if they have had to make their own travel arrangements to seek healthcare.

Table 12 – Median period of time from initial 111 call being answered to ambulance arrival on scene

<table>
<thead>
<tr>
<th>Initial 111 call triage</th>
<th>All Auckland St John incidents, year to June 2014</th>
<th>Incidents handled by the clinical hub, year to June 2015</th>
<th>Change in year of hub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>23min 32sec</td>
<td>37min 40sec</td>
<td>+14min 8 sec</td>
</tr>
<tr>
<td>Grey</td>
<td>27min 32sec</td>
<td>39 min 57sec</td>
<td>+12min 25sec</td>
</tr>
</tbody>
</table>

The delays identified above largely correspond to the median call-back window of 1 minute 44 seconds and median clinical hub call duration of 12 minutes 23 seconds.

A delay in ambulance attendance for clinical hub ‘grey’/‘green’ incidents is not inherently problematic, as these incidents would have received a thorough clinical assessment through the clinical hub and were assessed as being non-urgent. However, this population group (65% of hub users) is more likely than not to be worse off than if there was no clinical hub in operation: they are now receiving a slower ambulance response than they otherwise would have, with the accompanying clinical risks that that may entail for their individual condition.

The unnecessary delays being experienced by hub users who require ambulance attention makes a compelling case for St John to continually review which incidents/conditions are amenable to resolution over the telephone. Over time we would expect the successful rate of ‘hear and treat’ to increase and that fewer patients and that the delays associated with ambulance dispatch and arrivals to less urgent incidents will decrease.

**However, the hub provides a valuable opportunity to revisit the initial triage**

Despite the overall delay in ambulance attendance at less urgent incidents, the clinical hub can still provide some benefits to 111 callers in situations where an ambulance is ultimately still needed. The interaction between the clinical hub and the caller provides a valuable opportunity to improve upon the initial triaging done under ProQA. The triage nurse in the hub is clinically trained and the Odyssey software being used provides the basis for the nurse to elicit detailed information than the initial 111 call.

Any chance to improve upon the accuracy of the initial triage decision can provide direct benefits to patients and improve St John’s allocation decisions. Our examination of the hub shows the clinical assessment undertaken through the hub can often result in detection of symptoms/conditions that would otherwise not have been identified – and consequently an upgrade of the patient’s triage code and a more timely ambulance attendance.

Of those 15,889 incidents where an ambulance was dispatched following the clinical hub’s intervention:
- 26% had no change to their initial triage code,
- 73% had their initial triage upgraded, and
- 2% had their initial triage downgraded.
The extent to which a change was made to the initial triage code largely depends on what the initial triage code was. All ‘grey’ incidents have their triage code upgraded in order to be eligible for an ambulance dispatch. As is clear from the chart below, significant portions of ‘grey’ and ‘orange’ incidents had their triage code upgraded following interaction with the hub; whereas the more serious cases being handled by the hub (‘red’ and ‘purple’) were much less likely to have their initial triage revisited.

During the proof-of-concept period, 374 incidents were upgraded by the hub from ‘grey’/‘green’ to ‘red’ (potentially life threatening). In the absence of the hub, the initial triage codes would have stood. Without the hub this group of patients would have waited for an ambulance in line with a much slower timeframe that their triage level required. Instead, an ambulance arrived on the scene for these patients much faster than would have occurred if there was no clinical hub, potentially providing very real medical benefits for this group of patients.

9.1.3 111 callers who do not interact with the clinical hub benefit from faster ambulance responses

We have demonstrated above in Section 6.2 that, by reducing the need for St John to respond to low acuity incidents, the clinical hub has freed up ambulance resources and contributed to improvements in response times. As such, even though 80% of 111 callers in Auckland had no interaction with the clinical hub, many of these callers would have benefited from a faster ambulance response.
9.2 Surveys show a high level of patient satisfaction; albeit with a notable minority of dissatisfied 111 callers

As part of the evaluation framework St John and Sapere developed a survey methodology, whereby it was agreed 10 hub users would be randomly surveyed each week over the course of the proof-of-concept period.

The telephone survey was undertaken by Consumer Link and received responses from 482 hub users (2% of all hub users). The results have a margin of error of 5%.

9.2.1 Most users are very satisfied with their interaction with the clinical hub, the advice they received and the outcome

The majority of survey participants (76%) were satisfied with their experience of the clinical hub and over 50% of respondents stated that they were ‘very satisfied’. This satisfaction level is an average across the full year the survey and so incorporates the early period when there may well have been some start-up issues as staff began operating the hub for the first time – indeed the annual average of 76% satisfaction is a marked improvement of the initial satisfaction levels of ~69%.

![Figure 9 - Satisfaction with clinical hub experience](image)

The satisfaction of a hub user is related to whether their call resulted in an ambulance being dispatched. Reported satisfaction levels are slightly higher in cases where an ambulance was sent at 81% (satisfied and very satisfied), compared with ‘hear and treat’ cases where no ambulance was dispatched (71% satisfaction rate).

Only 4% of hub users reported being ‘dissatisfied’ and 9% being ‘very dissatisfied’. Clinical hub users were more likely to report being ‘very dissatisfied’ or ‘dissatisfied’ in cases where an ambulance was not sent (19% in total).
Clinical hub users were positive about the call taker
89% of clinical hub users felt the nurse they spoke to was reassuring and helpful; 79% felt they had opportunities to ask questions and to raise any concerns.

Importantly, 85% of hub users feel the nurse was interested in their views concerning care and treatment options and discussed those views with them. 12% felt the staff member was not interested in their views.

Most hub users agreed with the outcome of their clinical assessment
The majority of hub users surveyed agreed with the outcome of their clinical assessment, with 65% saying they definitely agreed and 21% reporting that they agreed with the outcome ‘to some extent’. Only 11% reported that ‘no’ they did not agree with the outcome of the assessment.

![Figure 10 - Agreement with the outcome of the clinical hub](image)

As may be expected, the satisfaction of hub users with the outcome of their interaction with the clinical hub is directly linked to whether an ambulance was dispatched. In the case of ‘hear and treat’ incidents, the proportion of users reporting they did not agree with the outcome of the assessment in incidents was almost twice that of the overall average at 19%.

Over half of users surveyed rated the advice as ‘excellent’
Over half (51%) of surveyed hub users rated the advice given to them by the clinical hub as ‘excellent’. The majority of users were satisfied with the advice provided with 87% rating the advice given ‘fair’ (8%), ‘good’ (28%) or excellent’. Only a small proportion were dissatisfied with the advice with 5% rating the advice as ‘poor’ and 6% rating it as ‘very poor’.
Importantly, hub users – regardless of whether they agreed with the advice – found the clinical advice given by the hub to be clear and easy to understand. Only 5% of hub users responded that they did not find the healthcare advice given to them to be easy to understand.

9.2.2 A small minority of hub users appear to have an unsatisfactory experience

From the survey results we can observe that there is a small, but material, group of hub users who appear to have a very unsatisfactory experience with the clinical hub. From those surveyed we note,

- 13% of hub users were ‘dissatisfied or ‘very dissatisfied’.
- 16% of users did not understand how the clinical hub worked, with 8% of respondents not understanding that it was a St John service.
- 11% did not agree with the outcome from the clinical hub. Of those for whom no ambulance was dispatched, 19% disagreed with the outcome of their call.
- 11% rated the advice they received as ‘poor’ or ‘very poor’.
- 14% rang 111 again about the same issue within 48 hours, with 71% of these callers having a subsequent ambulance dispatch (representing 10% of ‘hear and treat’ cases).

In our view, these figures are not necessarily concerning during the first 12 months of the hub. This is a period when there is likely to be very low levels of awareness of the purpose of the clinical hub and an expectation amongst many callers that ringing 111 will result in an ambulance being dispatched. What would be concerning is if these levels of dissatisfaction did not reduce over time.
Similar levels of dissatisfaction with ‘hear and treat’ are present in England

A comparison with a telephone survey of over 2,900 patients receiving ‘hear and treat’ advice in England shows similar levels of dissatisfaction amongst a small group of users.47 Indeed, St John’s survey results appear to be even more positive when viewed light of the results in England. Of those 999 callers who were rung back in England by a clinical advisor:

- 13% of English callers did not agree with the advice they were given (compared to 11% for St John). Amongst those for whom no ambulance was dispatched, 33% of English callers did not agree with the decision (compared to 19% for St John),
- 7% of English callers did not understand the clinical advice given at the end of the call (compared to 5% who felt the St John healthcare advice was not clear),
- 11% of English callers felt the call-taker they spoke with was not reassuring and 5% did not feel they were treated with dignity and respect (8% did not think the St John staff were reassuring and helpful),
- 15% contacted the ambulance service at least once within the following 7 days (compared to 14% for St John within 48 hours), and
- 9% of English callers rated the service between 0-4 on a 10 point satisfaction scale (13% of St John hub callers rated the service as ‘poor’ or ‘very poor’).

The similar dissatisfaction levels between the clinical hub and ‘hear and treat’ services in England not only indicate that the St John hub is operating well by comparison, but that it is not unusual for there to be a small proportion of dissatisfied patients.

9.3 There was likely a very small volume of patients adversely affected by the clinical hub

When considering the impact of the clinical hub on patients, it is important to reiterate the findings from the clinical audit examined earlier in Section 5 – that the hub is delivering a clinically safe service.

The clinical audit of 101 high-risk outcomes48 identified only two actual adverse events for patients (and one ‘possible adverse event). Such events are not normally distributed, but we note for indicative purposes that, if they were, then over the course of the 12 months we might expect that 15 callers were adversely affected by the clinical hub. As we have previously observed, the rate of adverse incidents is broadly consistent with overseas experiences in providing ‘hear and treat’.

47 See http://www.cqc.org.uk/content/ambulance-survey-hear-and-treat-callers-201314
48 Where no ambulance was dispatched and the patient was admitted to hospital within 7 days for at least one night
9.3.1 Complaint volumes from patients

During the 12 month period there were 65 complaints from patients, representing 0.3% of the 24,388 calls handled by the clinical hub. The complaint numbers were relatively evenly distributed throughout the 12 month evaluation window, with a peak of 10 complaints in October 2014 (0.5% of calls handled during the month).

St John’s subsequent internal review upheld 35 of the 65 complaints as being justified. Of the 35 upheld complaints, the overwhelming majority were about confusion about the new triage process and the fact that an ambulance had not been dispatched.

9.3.2 Falls is an area of disproportionate dissatisfaction

13 of the 35 upheld complaints (37%) concerned injuries associated with ‘falls’ – a much higher proportion than the category comprises of the total hub case mix (22% of incidents).

Through the clinical audit ‘falls’ were also identified as a category where there was likely to be greater clinical risk from providing ‘hear and treat’ advice to 111 calls – particularly in response to falls amongst the elderly and falls from height. We also observed that although ‘falls’ was the most common condition the clinical hub dealt with (22% of all incidents), it had a very low resolution rate, with only 23% of these incidents without an ambulance dispatch.

As per our earlier recommendation, we consider St John should undertake a work programme to review the impact the clinical hub is having on 111 calls about ‘falls’ to identify whether the resources of the clinical hub could be better applied within this category.
Appendix 1 – Conditions presenting to the clinical hub

For the purpose of this analysis, we have categorised the types of incidents (as initially identified by the 111 call taker using ProQA) presenting to the clinical hub in broad groupings. The following table explains what is covered by each category and the frequency with which incidents in that category presented to the clinical hub.

Table 13 - Categories of incident presenting to the clinical hub

<table>
<thead>
<tr>
<th>Category</th>
<th>Coverage</th>
<th>Total incident count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Incidents coded with the word ‘FALL’.</td>
<td>5,284</td>
</tr>
<tr>
<td>Sick person</td>
<td>Incidents coded with the words ‘SICK PERSON’, ‘NAUSEA’ and ‘VOMITING’.</td>
<td>3,958</td>
</tr>
<tr>
<td>Trauma</td>
<td>Includes incidents coded with the words ‘TRAUMA’, ‘ACUTE’, ‘GSW’ for gunshot wound, ‘MVC’ for motor vehicle accident, ‘and ‘STAB’.</td>
<td>2,905</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>Incidents coded with the words ‘ABDOMINAL PAIN’ or ‘ABDO PAIN’.</td>
<td>2,509</td>
</tr>
<tr>
<td>Bleeding</td>
<td>Incidents coded with the words ‘BLEED’ or ‘HAEM’.</td>
<td>1,890</td>
</tr>
<tr>
<td>Other</td>
<td>Includes a number of incidents that occurred relatively infrequently including: BITE, BURN, DIABETIC, CONSTIPATION, SURFACE WOUND INFECTION, CATHETER PROBLEM etc.</td>
<td>1,320</td>
</tr>
<tr>
<td>Back pain</td>
<td>Incidents coded with the words ‘BACK PAIN’ including traumatic back pain and non-traumatic back pain.</td>
<td>1,190</td>
</tr>
<tr>
<td>Faint</td>
<td>Includes incidents coded with the words ‘FAINT’, ‘UNCON’ and also ‘DIZZINESS’.</td>
<td>986</td>
</tr>
<tr>
<td>Immobility</td>
<td>Incidents coded with the words ‘NEW ONSET OF IMOBILITY’.</td>
<td>843</td>
</tr>
<tr>
<td>Fever</td>
<td>Incidents coded with the words ‘FEVER’.</td>
<td>553</td>
</tr>
<tr>
<td>Non-recent injury</td>
<td>Incidents coded with the words ‘NON-RECENT INJURY’</td>
<td>421</td>
</tr>
<tr>
<td>Category</td>
<td>Coverage</td>
<td>Total incident count</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Breathing difficulty</td>
<td>Includes incidents that are coded with ‘BREATHING’, ‘SOB’ for shortness of breath, ‘ASTHMA’ and ‘CHOKING’.</td>
<td>367</td>
</tr>
<tr>
<td>Assault</td>
<td>Incidents coded using the word ‘ASSAULT’ including sexual assault.</td>
<td>295</td>
</tr>
<tr>
<td>Psych/abnormal behaviour</td>
<td>Includes incidents coded using the words ‘PSYCH’, ‘SUICIDAL’ and ‘ABNORMAL BEHAVIOUR’.</td>
<td>286</td>
</tr>
<tr>
<td>Rash/Allergy</td>
<td>Includes incidents coded with the words ‘RASH’ or ‘ALLERGY’</td>
<td>265</td>
</tr>
<tr>
<td>Headache</td>
<td>Includes incidents coded with the words ‘HEADACHE’</td>
<td>262</td>
</tr>
<tr>
<td>Chest pain</td>
<td>Includes incidents coded with the words ‘CHEST PAIN’ and ‘HEART’.</td>
<td>260</td>
</tr>
<tr>
<td>Cramp/spasm/joint pain</td>
<td>Includes incidents coded with the words “CRAMP/SPASM/JOINT PAIN”</td>
<td>232</td>
</tr>
<tr>
<td>General Weakness</td>
<td>Incidents coded with the words ‘GENERAL WEAKNESS’.</td>
<td>197</td>
</tr>
<tr>
<td>Hazardous substance</td>
<td>Incidents coded with the words ‘HAZ’, and ‘OD’ and ‘POISON’.</td>
<td>169</td>
</tr>
<tr>
<td>Pregnancy related</td>
<td>Incidents coded with the words ‘BIRTH’ ‘TRIMESTER’, and ‘PREG’.</td>
<td>123</td>
</tr>
<tr>
<td>Fit</td>
<td>Includes incidents coded with the words ‘FIT’ or ‘FITTING’.</td>
<td>51</td>
</tr>
<tr>
<td>Stroke</td>
<td>Includes incidents coded with ‘CVA’ which refers to cerebrovascular accident more commonly referred to as a stroke.</td>
<td>22</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>24,388</td>
</tr>
</tbody>
</table>
Appendix 2 – Forecasting ED transports without the clinical hub

This appendix contains the details of modelling used to project likely ED transport volumes if there had been no clinical hub in place for the period June 2014 to July 2015. It outlines:

• a long-list of possible approaches to modelling transport volumes,
• the 17 detailed models we developed through the 2014 evaluation framework,
• how we subsequently refined the two favoured models, and
• the final forecasts of what would have occurred if there was no clinical hub.

A Long-list of possible approaches to modelling

<table>
<thead>
<tr>
<th>Approach / model</th>
<th>Description</th>
<th>Sapere Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attribute change in transport volumes from previous year to hub</td>
<td>Assume transport volumes would have been static and any change from previous year is attributable to hub</td>
<td>• Does not take into account changes in incident volumes&lt;br&gt;• Trends are important: previous year could have been an anomaly&lt;br&gt;• Would not capture changes in underlying drivers of demand (e.g. population)</td>
</tr>
<tr>
<td>2. Estimate ED transport volumes by applying previous year’s transportation rate to 2014/15 incident volumes</td>
<td>Assume likelihood of an ambulance incident being transported to ED in 2014/15 would have been the same as 2013/14. Any difference can be attributed to the hub.</td>
<td>• Transport rates are not static: rate is continually reducing due to training and organisational changes; and ongoing increase in volumes of low acuity incidents&lt;br&gt;• No reason previous year’s rate is preferable to other years&lt;br&gt;• Risks not accounting for ‘induced demand’</td>
</tr>
<tr>
<td>3. Use ‘hear and treat’ volumes as proxy for avoided ED transports</td>
<td>Assume all ‘hear and treat’ incidents handled by the hub would have otherwise been transported to ED</td>
<td>• Many ‘hear and treat’ incidents would be low acuity and would otherwise have been treated at the scene by ambulance officers or transported to medical centres.&lt;br&gt;• Would not account for situation where ‘hear and treat’ user rings 111 again and receives a transport (survey indicates ~10%)&lt;br&gt;• Would not capture changes in underlying drivers of demand</td>
</tr>
<tr>
<td>4. Time series modelling</td>
<td>Use historic ED transport</td>
<td>• Likely to be accurate as transport</td>
</tr>
</tbody>
</table>
Development of detailed models

Through the evaluation framework we identified two preferred models for predicting ED transport volumes in Auckland: one time series and one control group model. We briefly summarise below the 17 models that were tested as part of this process.

1. Development of time series models

Our analysis involves various models, which normally have diverse goodness of fit tests. In order to make comparisons of forecasts across different models, we assess the average prediction error of each model. To compute prediction errors, we remove the latest 12 months data from the dataset and apply each model to the reduced dataset to make predictions for those 12 months.

The formula of the average prediction error is:

\[
\sqrt{\frac{\sum (\text{prediction}(i) - \text{actual}(i))^2}{12}}
\]

In addition, we also assess the width of 95% prediction interval. A narrower 95% prediction interval suggests a better certainty of forecasts. In sum, the prediction error would evaluate how accurate our forecasts are and the width of 95% prediction would tell how certain we are about our forecasts.

Possible Models

Overall the number of transportation to 5 EDs in Auckland increased dramatically from 2009 to 2011, and then remained stationary until April 2014. The seasonal variation remained comparatively constant after 2011.

Based on the feature of this time series, there are two choices of using the data: using data from 2009 or using data from 2011. The Average Prediction Errors listed below reference...
the ability of the model to predict actual monthly transport data for the last year of available data.

**First choice: Using data starting from 2009**
This is a non-stationary time series, which requires models to capture both increasing trend and seasonal variations.

**Model 1: Quadratic trend and monthly factor regression**
As the trend of this time series is not linearly increasing, it is common to use a quadratic time term to model the trend. Figure 1 suggests a monthly factor to measure the seasonal variations.

Average Prediction Error = 527

**Model 2: Time break and monthly factor regression**
Instead of regarding this as a non-linear trend, we consider that there is a critical break point at January 2011, before this point, there is a linear increasing trend and after there is a stationary trend.

Average Prediction Error = 205

**Model 3: Seasonal harmonic model**
Based on the complexity and regularity of the seasonal component, we use multiple sine and cosine curves to model a not regular “smooth” curve completing one cycle per year. And considering the average prediction error, we use a time break to model the trend.

Average Prediction Error = 160

**Model 4: Holt-Winters model**
Holt-Winters exponential smoothing method can be used for forecasting on most time series, stationary or non-stationary.

Average Prediction Error = 288

**Second choice: Using data starting from 2011**
This is a stationary time series, which requires models to capture only seasonal variations.

**Model 5: Monthly factor regression**
Average Prediction Error = 191

**Model 6: ARIMA model**
In addition to a monthly factor, we use an order 1 seasonal autoregressive model (part of ARIMA model) as we also found seasonal time dependence.

Average Prediction Error = 161

**Model 7: Seasonal harmonic model**
Average Prediction Error = 152

**Model 8: Holt-Winters model**
Average Prediction Error = 397
Final time-series model
To achieve both accuracy and certainty, we compared Model 3, Model 6 and Model 7 as they give three smallest average prediction errors, and then we found Model 6 (ARIMA model) is the best model, which has narrowest 95% prediction interval.

2. Development of control group models
We introduced regression models in order to capture any future possible changes in qualitative factors, which a time series model is unlikely able to predict. Regression analysis is widely used for prediction and forecasting, which is a statistical process for estimating the relationships among variables. Stepwise regression includes regression models in which the choice of predictive variables is carried out by an automatic procedure.

We used backward elimination as our main approach, which involves starting with all candidate variables, testing the deletion of each variable using a chosen model comparison criterion (p values for t-tests), deleting the variable (if any) that improves the model the most by being deleted, and repeating this process until no further improvement is possible.

The models presented here use data for all transports in non-Auckland regions as a means of predicting Auckland ED transports. Our analysis shows this approach provides a more accurate model that only using data from non-Auckland regions where the patient was transported to ED.

Measurement of ‘Goodness of Fit’
R square is a common measurement in regression analysis, indicating how well data points fit a statistical model. A model with R square greater than 80% is a reasonable model and with R square greater than 90% is an accurate model for prediction.

Adjusted R square is R square value adjusted for the number of variables in the model. We use it to compare models with different numbers of variables, since R square value always increases as the number of variables increases. In sum, we use adjusted R square to compare how well each model fits the data and average prediction error per month for the latest 12 months to estimate how accurate our forecasts are.

Possible Models
Based on the data structure, we could use District, DHB or Territory as a grouping factor. The numbering below starts from ‘9’ to enable comparisons to the forecasts using Auckland data only (above).

Grouping by District
After cleaning the data (deleting groups with missing values and Auckland related regions), there are 10 District groups: Bay of Plenty, Canterbury, Coromandel, Hawke’s Bay, Northland, Southern Lakes, Taranaki, Tasman, Waikato and Waitaki.

Model 9: Model from Backward elimination
ED=Coromandel +Hawke’s Bay +Northland +Southern Lakes +Waikato
Adjusted R square = 85%         Average Prediction Error =277

Model 10: Adjusted Model 9 with higher polynomials
ED=poly (Coromandel, 3) +poly (Northland, 3) +Southern Lakes + Waikato
Adjusted R square = 86%         Average Prediction Error =288
In model 9, we assumed all districts are linearly related to ED, however, the figures below showed not all relationships are linear.

Model 11: Adjusted Model 9 with a break
ED=Coromandel_above425 +Northland_below967 +Northland_above967 +Southern Lakes +Waikato

Adjusted R square = 89%       Average Prediction Error =154

In Model 10, the cubic terms did not capture the characteristics of the ED data, thus we have a larger average prediction error although the adjusted R square increased slightly.

The correlation between Auckland ED transports and the four control areas is mapped below.
The figure above illustrates that there is a break point of the transportation in Coromandel between 400 and 450. Thus instead of cubic power, we separate one variable into two by the break point. To find the break point, we use an optimised algorithm looking for a value between 400 and 450, which would produce a smallest average prediction error (break point is 425). Only where transports in the Coromandel exceed 425 will they be used in the model.

Similarly, the break point of the transportation in Northland is 967 – both parts are utilised in the model.

**Model 12: Adjusted Model 11 with ARIMA model**

*Average Prediction Error = 143*
The above ACF plot shows there are significant lags at lag 4, lag 8 and lag 12 indicating time dependence. Therefore, we apply a seasonal autoregressive model.

**Grouping by DHB**
After cleaning the data, there are 10 DHB groups: Bay of Plenty, Canterbury, Lakes, Nelson Marlborough, Northland, Southern, South Canterbury, Tairawhiti, Waikato, and West Coast.

**Model 13: Model from Backward elimination**
ED = Month + Bay of Plenty + Northland + Southern + South Canterbury + Tairawhiti + Waikato

Adjusted R square = 88%  
Average Prediction Error = 256

**Model 14: Adjusted Model 13 with higher polynomials**
ED = Month + Bay of Plenty + Northland + Southern + poly(Tairawhiti,2) + Waikato

Adjusted R square = 89%  
Average Prediction Error = 298

**Model 15: Adjusted Model 13 with a break**
ED = Month + Bay of Plenty + Northland + Southern + Tairawhiti_after425 + Waikato

Adjusted R square = 88%  
Average Prediction Error = 246

**Grouping by Territory**
After cleaning the data, there are 28 territory groups: Avon/Otakaro, Buller, Central Otago, East Coromandel, Eastern BoP, Far North, Hamilton, Hauraki, Hokonui, Lakes, Marlborough, Mid Canterbury, Mid North, Nelson Bays, North Canterbury, North Otago, North Waikato, Otago, Ruapehu, South Canterbury, Southern, Tairawhiti, Taupo, Waimakariri, Waitomo, West Coast, Western BoP, and Whangarei.

**Model 16: Model from Backward elimination**
ED = East Coromandel + Hamilton + Lakes + Mid Canterbury + Ruapehu + South Canterbury + Southern + Waimakariri + West Coast + Whangarei

Adjusted R square = 90%  
Average Prediction Error = 220
Model 17: Adjusted Model 16 with higher polynomials
ED=East Coromandel + Hamilton + Lakes + Mid Canterbury + Ruapehu + South Canterbury + Southern + Waimakariri + poly (West Coast, 2) + Whangarei

Adjusted R square = 91%       Average Prediction Error =208

Final control group model
Model 12 is the best model as it has the smallest general average prediction error.

Refining the two preferred models
Many of the decisions on the applicable models were made through the 2014 evaluation framework, where two approaches were favoured:

- Time series: 8 time series models were examined and it was agreed the ARIMA model would be applied to provide a time series projection of transport volumes.

- A control group: 9 control group models were tested and we noted that a control group model at St John District level incorporating Waikato, Northland, Coromandel and the Southern Lakes was most applicable to project Auckland transport volumes.

We have now updated these models, which were previously based on data up until April 2014 – and have examined whether adding two more months of data (May and June 2014) during the hub’s soft launch is likely to improve the models.

1. Adjusted Time Series Model

The time series from 2011 is a relatively stationary series and we therefore built our model using data from January 2011 to June 2014. The seasonal effects are clear: the volume of transports to ED has an increasing trend from January and then reaches its peak in July/August and then decreases. May 2014 and June 2014 (soft launch of the clinical hub) are consistent with the past pattern (without clinical hub). All monthly transport volumes in June for 4 years are around 7,500.
Testing the time-series model
Based on the newly provided data, we fitted an order 1 seasonal autoregressive ARIMA model with a monthly factor. Average Prediction Error = 181

This error is larger than the previous model developed for the evaluation framework (161), but since the months we predicted are not the same, the figure below shows the adjusted prediction without May and June in 2014.

The time series model is more sensitive to the changes because we have less data (only from 2011 instead of 2009) to build the model. Therefore, the time series model would be more robust if we use the newly provided data but leave May and June 2014 out (soft launch).
### Adjusted Time Series Forecast

<table>
<thead>
<tr>
<th>Month</th>
<th>Forecasted Incidents</th>
<th>95% Lower Bound</th>
<th>95% Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul-14</td>
<td>8,279</td>
<td>7,968</td>
<td>8,590</td>
</tr>
<tr>
<td>Aug-14</td>
<td>7,989</td>
<td>7,678</td>
<td>8,301</td>
</tr>
<tr>
<td>Sep-14</td>
<td>7,715</td>
<td>7,404</td>
<td>8,027</td>
</tr>
<tr>
<td>Oct-14</td>
<td>7,524</td>
<td>7,212</td>
<td>7,835</td>
</tr>
<tr>
<td>Nov-14</td>
<td>7,087</td>
<td>6,775</td>
<td>7,398</td>
</tr>
<tr>
<td>Dec-14</td>
<td>7,455</td>
<td>7,144</td>
<td>7,767</td>
</tr>
<tr>
<td>Jan-15</td>
<td>6,907</td>
<td>6,596</td>
<td>7,219</td>
</tr>
<tr>
<td>Feb-15</td>
<td>7,375</td>
<td>7,064</td>
<td>7,686</td>
</tr>
<tr>
<td>Mar-15</td>
<td>7,492</td>
<td>7,180</td>
<td>7,803</td>
</tr>
<tr>
<td>Apr-15</td>
<td>7,107</td>
<td>6,795</td>
<td>7,418</td>
</tr>
<tr>
<td>May-15</td>
<td>7,472</td>
<td>7,104</td>
<td>7,841</td>
</tr>
<tr>
<td>Jun-15</td>
<td>7,583</td>
<td>7,215</td>
<td>7,952</td>
</tr>
</tbody>
</table>
2. Adjusted Control Group Model

The figure above shows that the number of transports to ED in Auckland from January 2009 to June 2014 obtained from St John in 2015.

The number of transports to ED in Auckland increased dramatically from 2009 to 2011. From 2011, the series became reasonably stationary with constant seasonal component. Although the clinical started with a soft launch in May 2014, we could see the figures in May and June in 2014 are even slightly higher than that in May and June in 2013, indicating that it was unlikely the clinical hub had any real impact at this time.

Based on the results from last year, district is the best grouping factor. We subset the full dataset by DESTINATION CENTRE TYPE including records only for Smaller Centre Hospitals and Major Hospitals and then group by District. There are 10 District groups: Bay of Plenty, Canterbury, Hauraki / Coromandel, Hawke’s Bay, Northland, Southern Lakes, Taranaki, Tasman, Waikato and Waitaki. Rename Hauraki / Coromandel as Coromandel for simplicity.

Model 1: Model from backward elimination
ED=Coromandel + Hawke’s Bay + Northland + Southern Lakes + Waikato

Adjusted R square = 85% Average Prediction Error = 156

Model 2: Adjusted Model 1 with a break
ED=Coromandel_below401 + Southern Lakes + Waikato_below1161 + Waikato_above1161

Adjusted R square = 88% Average Prediction Error = 132
The figure above illustrates that there is a break point of the transportation in Coromandel between 400 and 430. To find the break point, we use an optimised algorithm looking for a value between 400 and 430, which would produce a smallest average prediction error (break point is 401). Only where transports in the Coromandel are below 401 will they be used in the model.

Similarly, the break point of the transportation in Waikato is 1161 – both parts are utilised in the model.

### Model 2 Prediction for 2013-2014

![Model 2 Prediction for 2013-2014](image)

Adjusted model 2 is better since it has a smaller prediction error and is easy to compare with the actual data in 2015. We note the best model based on last year data has a prediction error of 143.
From the figure above, we could clearly see the clinical hub started to have a noticeable impact from October 2014. From November 2014 the actual number of transports to ED is below the 95% CI of the forecasts and it follows the same pattern with the forecast until May 2015.

<table>
<thead>
<tr>
<th></th>
<th>Forecasted incidents</th>
<th>95% lower bound</th>
<th>95% upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul-14</td>
<td>7,995</td>
<td>7,641</td>
<td>8,350</td>
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<tr>
<td>Aug-14</td>
<td>7,805</td>
<td>7,451</td>
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<td>Sep-14</td>
<td>7,482</td>
<td>7,128</td>
<td>7,836</td>
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<td>Oct-14</td>
<td>7,594</td>
<td>7,240</td>
<td>7,948</td>
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<tr>
<td>Nov-14</td>
<td>7,583</td>
<td>7,229</td>
<td>7,937</td>
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<tr>
<td>Dec-14</td>
<td>7,543</td>
<td>7,189</td>
<td>7,897</td>
</tr>
<tr>
<td>Jan-15</td>
<td>7,256</td>
<td>6,902</td>
<td>7,610</td>
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<td>Feb-15</td>
<td>7,078</td>
<td>6,724</td>
<td>7,432</td>
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<td>Mar-15</td>
<td>7,865</td>
<td>7,511</td>
<td>8,219</td>
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<tr>
<td>Apr-15</td>
<td>7,337</td>
<td>6,983</td>
<td>7,691</td>
</tr>
<tr>
<td>May-15</td>
<td>7,414</td>
<td>7,060</td>
<td>7,768</td>
</tr>
<tr>
<td>Jun-15</td>
<td>8,135</td>
<td>7,781</td>
<td>8,489</td>
</tr>
</tbody>
</table>
Accuracy of the two models

Both models (adjusted Time Series model and adjusted Control Group model) based on the updated datasets are preferred to the ones developed through the evaluation framework.

Adjusted Control Group model is more accurate than the adjusted Time Series model as it has a smaller average prediction error 132 than the time series model (163). Moreover, adjusted Control Group model is based on all past data from January 2009 including May and June 2014 while the Time Series model is based on partial past data from January 2011 excluding May and June 2014 due to the nature of stationary time series. Therefore, the adjusted Control Group Model is more reliable. We note that the updated control group model has been improved through the exclusion of data on Northland transports.

Final Forecast of Transports to ED in Auckland

The adjusted control group model forecasts that, in the absence of the clinical hub, there would likely have been 91,087 St John transports to Auckland EDs. The 95% confidence interval is between 89,862 and 92,314.
Technical details of models

Control Group Model 2 Summary

Call:

```r
lm(formula = ED ~ Coromandel_below401 + SouthernLakes + Waikato_below1161 + 
    Waikato_above1161, data = data[1:66, ])
```

Residuals:

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-358.35</td>
<td>-102.31</td>
<td>-38.75</td>
<td>76.41</td>
<td>734.88</td>
</tr>
</tbody>
</table>

Coefficients:

|                     | Estimate | Std. Error | t value | Pr(>|t|) |
|---------------------|----------|------------|---------|---------|
| (Intercept)          | 628.4294 | 431.8597   | 1.455   | 0.150749|
| Coromandel_below401  | 0.5391   | 0.1912     | 2.820   | 0.006468** |
SouthernLakes  1.8021  0.4590  3.926  0.000223 ***
Waikato_below1161  3.2420  0.2811  11.532 < 2e-16 ***
Waikato_above1161  3.0877  0.2485  12.424 < 2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 187.9 on 61 degrees of freedom
Multiple R-squared: 0.8852, Adjusted R-squared: 0.8777
F-statistic: 117.6 on 4 and 61 DF, p-value: < 2.2e-16

Time series Model
Series: ED[1:40]
ARIMA(0,0,0)(1,0,0)[12] with non-zero mean

Coefficients:
sar1 intercept Jan    Feb    Mar    Apr    May
  -0.6337  7345.5118 -297.4977 -183.6997  112.8376 -213.4613  204.4488
s.e.   0.1235   65.2019   84.7898   85.1329   84.7314   84.7437   92.2805
       Jun    Jul    Aug    Sep    Oct    Nov
  277.4927  847.5070  758.9859  425.5981  183.3162 -175.7457
s.e.    92.2889   92.1908   92.5658   92.8459   92.8006   92.2115

sigma^2 estimated as 25217: log likelihood=-262.54
AIC=553.09  AICc=569.89  BIC=576.73
Appendix 3 – Matching St John and DHB datasets

As part of this evaluation we endeavoured to track the outcomes of those patients who received ‘hear and treat’ advice from St John upon calling 111.

Historically St John has not captured NHIs or patient identifying information, beyond address of the call-out. This meant we were unable to compare patient outcomes before the proof-of-concept period and during the proof-of-concept period.

Sourcing NHIs for clinical hub users

However, when clinicians sitting within the clinical hub contacted the 111 caller to provide secondary triaging, they recorded the patient’s demographic and contact details within the Odyssey clinical system. Administrators would then extract those details post-call and search their NHIs on the MOH NHI Lookup system or against the Homecare Medical’s patient register from ProCare PHO, whom they are a subsidiary. They would then retrospectively reinsert the NHI into the clinical record for future reference. The availability of NHIs for clinical hub users means we are able to identify those patients that subsequently present in secondary care.

However, NHI numbers are not available for all clinical hub users. This is because:

- In the early stages of the pilot, NHI lookup tools were not available to either Homecare Medical or St John. In addition, inadequate training was provided to clinical hub staff on how to ask demographic questions without a negative response by the patient.
- In situations when a patient hangs up or refuses to engage with the clinical hub (including becoming abusive), there is often not enough unique patient information captured to provide an NHI number.
- NHIs cannot be sourced if callers provide their preferred names or the call-taker incorrectly spells first name or surnames

The net effect is that, until December 2014 valid NHIs are only available for 65% of all clinical hub users; with 79% available in the second half of the pilot. Overall, NHIs were available for 73.9% for clinical hub calls during the 12 month period.

DHB matching

The Auckland DHBs agreed to facilitate access to monthly datasets listing the distinct NHIs that present at Auckland, Starship, Middlemore, North Shore and Waitakere ED during the proof of concept period. NHIs were provided securely via Healthlink from each DHB Decision Support teams.

Every quarter, as agreed with the Ministry of Health’s (MOH) Analytical Services team, a file containing all NHIs from the DHBs of presenting patients at ED was submitted, together with a unique GUID (encrypted NHI). MOH would then match all relevant fields covering patient demographics, attendance, diagnosis and outcome records from National Non-
Admitted Patient Collections (NNPAC), as well as the National Minimum DataSet (NMDS). MOH would replace NHI field from NNPAC and NMDS with the GUID and provide the extracts back in a secure courier disc.

St John then matched the NHIs found in their clinical records (by the date of interventions), against the NMDS/NNPAC records that contain GUIDs by time of event (using a reference NHI to GUID table to match). Only those that match one of St John NHIs would be identified. This method would identify those patients who were provided with self-care advice and did were not transported by ambulance, but later self-presented to ED.

This methodology was also used to match against inpatient records for clinical hub users and was used to identify the sample of patient records to subject to a clinical audit.
The figure above shows that the number of EAS incidents in Auckland from January 2009 to June 2014 obtained from St John in 2015.
Those two figures above show the relationship between Auckland and other districts. We could see that Bay of Plenty, Canterbury, Northland, Southern Lakes, Waikato and Waitaki are highly correlated and the relationships are reasonably linear.

**Grouping by District**

Based on the results from last year, district is the best grouping factor. There are 11 District groups: Bay of Plenty, Canterbury, Hauraki/Coromandel, Hawke’s Bay, Manawatu, Northland, Southern Lakes, Taranaki, Tasman, Waikato and Waitaki.

**Possible Models**

Model 1: Model from Backward elimination

EAS incidents = Bay of Plenty + Canterbury + Hauraki /Coromandel + Northland + Southern Lakes + Waikato + Waitaki

Adjusted R square = 94%     Average Prediction Error = 192

Model 2: Adjusted Model 1 with a break

EAS incidents = Bay of Plenty + Canterbury + Hauraki /Coromandel_above516 + Northland + Southern Lakes + Waikato + Waitaki

Adjusted R square = 94%     Average Prediction Error = 166

The figure above illustrates that there is a break point of the transportation in Hauraki /Coromandel between 500 and 600. To find the break point, we use an optimised algorithm.
looking for a value between 500 and 600, which would produce a smallest average prediction error (break point is 516). Only where transports in the Hauraki /Coromandel above 516 will they be used in the model.

Model 2 is favoured as it has a smaller prediction error.
The following table provides the monthly incident prediction figures using the control group model.

<table>
<thead>
<tr>
<th></th>
<th>Forecasted incidents</th>
<th>95% lower bound</th>
<th>95% upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul-14</td>
<td>10,791</td>
<td>10,465</td>
<td>11,116</td>
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<tr>
<td>Aug-14</td>
<td>10,966</td>
<td>10,640</td>
<td>11,291</td>
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<tr>
<td>Sep-14</td>
<td>10,147</td>
<td>9,821</td>
<td>10,472</td>
</tr>
<tr>
<td>Oct-14</td>
<td>10,226</td>
<td>9,900</td>
<td>10,551</td>
</tr>
<tr>
<td>Nov-14</td>
<td>10,080</td>
<td>9,755</td>
<td>10,406</td>
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<tr>
<td>Dec-14</td>
<td>10,494</td>
<td>10,168</td>
<td>10,819</td>
</tr>
<tr>
<td>Jan-15</td>
<td>10,346</td>
<td>10,021</td>
<td>10,671</td>
</tr>
<tr>
<td>Feb-15</td>
<td>9,394</td>
<td>9,069</td>
<td>9,719</td>
</tr>
<tr>
<td>Mar-15</td>
<td>10,540</td>
<td>10,215</td>
<td>10,866</td>
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<tr>
<td>Apr-15</td>
<td>9,775</td>
<td>9,449</td>
<td>10,100</td>
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<td>May-15</td>
<td>10,638</td>
<td>10,313</td>
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<tr>
<td>Jun-15</td>
<td>10,768</td>
<td>10,443</td>
<td>11,093</td>
</tr>
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</table>
Adjusted Time Series Model

There is clearly an increasing trend for this time series from 2009 to 2014. The seasonal effects are obvious: the number of EAS incidents has an increasing trend from January and then reached its peak at July or August and then decreases. May 2014 and June 2014 (with clinical hub) do not look anomaly from the past pattern (without clinical hub).

Adjusted model

Based on new data, we fit an order 1 seasonal autoregressive and order 1 moving average ARIMA model with a monthly factor.

Average Prediction Error =185
This error is larger than the old model (180), but the months we predicted are not the same and the difference is very small. Therefore, we should use the updated time series model.

<table>
<thead>
<tr>
<th></th>
<th>Forecasted incidents</th>
<th>95% lower bound</th>
<th>95% upper bound</th>
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<tbody>
<tr>
<td>Jul-14</td>
<td>11,010</td>
<td>10,605</td>
<td>11,416</td>
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<tr>
<td>Aug-14</td>
<td>10,937</td>
<td>10,515</td>
<td>11,358</td>
</tr>
</tbody>
</table>
Accuracy of the two models

The models (adjusted Time Series model and adjusted Control Group model) based on new dataset are preferred, because our purpose is to compare the forecasts with the actual data from July 2014 to June 2015, where they came from the new dataset.

The Adjusted Control Group model is more accurate than the adjusted Time Series model as it has a smaller average prediction error 166 than the time series model (185).

Final Forecast of EAS incidents in Auckland

The adjusted control group model predicts that, if there had been no clinical hub during the period July 2014 to June 2015 then St John would have handled 124,164 incidents in the Auckland region. This compares to the 124,091 incidents actually experienced by St John.
Calculation

Control Group Model 2 Summary
lm(formula = Auckland ~ BayofPlenty + Canterbury + HaurakiCoromandel_above516 + Northland + SouthernLakes + Waikato + Waitaki, data = d_new[1:66, ])

Residuals:
  Min   1Q Median   3Q   Max
-370.20 -127.58  -3.61 103.41 353.78

Coefficients:
  Estimate Std. Error t value Pr(>|t|)
(Intercept)   -836.41316  372.00566  -2.248  0.028367 *
BayofPlenty    1.15894   0.31470   3.683  0.000508 ***
Canterbury     0.43833   0.16365   2.679  0.009605 **
HaurakiCoromandel_above516  -0.49081   0.09944  -4.936 7.08e-06 ***
Northland     0.92379   0.40809   2.264  0.027350 *
SouthernLakes   0.89997   0.28953   3.108  0.002913 **
Waikato        0.77175   0.29750   2.594  0.011987 *
Waitaki       1.11540   0.27287   4.088  0.000136 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 177.1 on 58 degrees of freedom
Multiple R-squared: 0.9478,  Adjusted R-squared: 0.9415
F-statistic: 150.4 on 7 and 58 DF, p-value: < 2.2e-16

Time series Model
ARIMA(1,0,1) with non-zero mean

Coefficients:
<p>| | | | | | | | | |</p>
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<td>arl</td>
<td>ma1</td>
<td>intercept</td>
<td>Time</td>
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<td>Feb</td>
<td>Mar</td>
<td>Apr</td>
<td>May</td>
</tr>
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<td>27.2475</td>
<td>-525.1339</td>
<td>-958.9448</td>
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<td>s.e.</td>
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<td>110.3726</td>
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<tr>
<td></td>
<td>sigma^2 estimated as 42721: log likelihood=-445.73</td>
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</tr>
<tr>
<td>AIC=923.45  AICc=934.56  BIC=958.49</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Appendix 5 – Origin of transports to ED

The following charts show where EAS transports to Auckland EDs originate. The first two maps show the total volume of transports (for the year preceding the hub and during the hub), while the following map shows the extent to which the rate of transports per 1,000 population changed from the preceding year (effectively netting off any changes in underlying population).

Origin of ED transports: year to June 2014 (prior to clinical hub):
Origin of ED transports: year to June 2015 (during the clinical hub)
Changes in ED transports: year to June 2015, per 1,000 population
(showing decrease/increase in rate per 1,000 residents)
Annual growth in ED transports

Year to June 2012

Year to June 2013

Year to June 2014

Year to June 2015
Appendix 6 – Transports by day of the week

The following charts show a time series for Auckland ED transports, broken down by day of the week. Prior to the intervention of the clinical hub there was a fairly stable time series: with transports falling across each of the days after the introduction of the hub (most pronounced on Saturday and Thursday).
The following charts compare transports by day of the week for the years to June 2014 and 2015 (during which period the hub was operational). The charts highlight a degree of volatility in the figures, but also clear reduction in transport volumes over time.

Number of transports to ED by day of week in 2014 and 2015
Appendix 7 – Survey results

Demographic details of hub user survey population

The following provides the demographic profile for respondents for the period July 2014-July 2015. The proportion of female and male hub users as represented in the survey population was 51% and 49% respectively.

Figure 12 - Age of hub user survey population July 2014-July 2015 (n=480)

An age profile break down of surveyed hub users shows that the age bracket with the highest number of hub users was 20-30 years who made up 17.7% (85/480) of hub users surveyed. The next highest was the 31-40 years age bracket with 72 hub users out of 480. Numbers across the age brackets 51-60, 61-70 and 71-80 were very similar with these brackets representing 64, 65 and 61 users respectively or on average 13 per cent of hub users surveyed each. Of hub users surveyed during the year to date, only 38 were 19 and under, 39 were in the 81-90 age bracket and only one was in the 91 years and over age bracket.

Clinical hub users understood how the clinical hub service worked

Survey respondents were asked about their understanding of the hub:

“Did you understand from what you were told by the initial 111 call handler, how the new Clinical Hub service works?”

The chart below illustrates responses from all hub users in the survey population (482).
The chart illustrates that the majority of hub users in the survey population considered that they understood, at least to some extent, how the clinical hub service works from what they were told by the initial 111 call handler. With 53 per cent responding that they definitely understood and 27 responding that they understood to some extent. 16 per cent reported that they did not understand how the services works from what they were told by the initial 111 call holder and 4 per cent responded that they weren’t sure or couldn’t remember.

This level of understanding is reasonably consistent with the results reported for the survey sub-population who are recorded as being members of the supporters scheme (n =148). However understanding was lower for Medical Alarm users among the survey population, with only 40 per cent responding that they definitely understood and 33 per cent responding that they understood to some extent.

Additionally, respondents were asked if it was clear to them that this was a St John service. In response to this question, 71 per cent said ‘yes, definitely’, 17 per cent said ‘yes, to some extent’, 8 per cent said ‘no’ and 4 per cent ‘not sure/can’t remember’.

**Clinical hub users surveyed were generally satisfied with call back times**

Clinical hub users surveyed were asked how they about the length of time they waited before they were called back by a St John Clinical hub Nurse.
The chart above illustrates that the majority of those surveyed were positive about call back times with 73 per cent reporting that call back times were quicker than, or about what they thought it would be. 23 per cent thought that the call back should have been either a bit or a lot sooner.

**Thoughts on advice given**

Clinical hub users surveyed were asked a series of questions about their thoughts on the advice given to them by the nurses.

**The majority of hub users surveyed felt that advice was given in a way that was easy to understand**

The hub users surveyed were asked: *Did the Nurse explain the healthcare advice they gave you in a way that was easy to understand?*
Over half of users surveyed rated the advice as ‘excellent’

The hub users surveyed we asked to rate the healthcare advice they were given by the Nurse.

Clinical hub user ratings of advice provided by the Nurse, July 2014-July 2015 (482)

Over half (51 per cent) of clinical hub users surveyed over the year July 2014-July 2014 rated the advice given to them by the Nurse as ‘excellent’. The majority of users were satisfied with the advice provided with 87 per cent rating the advice given ‘Fair’ (8 per cent), ‘Good’ (28 per cent) or ‘Excellent’. Only a small proportion were dissatisfied with the advice with 5 per cent rating the advice as ‘Poor’ and 6 per cent rating it as ‘Very Poor’.
The majority of hub users surveyed felt that the Nurse was helpful and reassuring
Clinical hub users surveyed were asked:

“Throughout the call was the Nurse helpful and reassuring?”

Opinions of hub users surveyed on whether Nurses were helpful and reassuring, July 2014-July 2015 (n=482)

Most hub users surveyed were satisfied that the Nurses had been helpful and reassuring throughout the call with 71 per cent saying that they definitely were, and 18 percent saying they were helpful and reassuring to some extent. Just 9 per cent of hub users surveyed answered ‘No’ that they did not feel that the Nurse was helpful and reassuring throughout the call.

Clinical hub users surveyed generally considered they had been given the opportunity to ask questions or raise concerns
Clinical hub users surveyed were asked:

_Were you or the person concerned given the opportunity to ask questions or raise concerns?_
Opinions of clinical hub users on whether they were given the opportunity to ask questions or raise concerns, July 2014 – July 2015 (n=482)

Over half of clinical hub users surveyed considered that they had definitely been given the opportunity to ask questions or raise concerns, while 21 per cent considered that they had been given the opportunity ‘to some extent’. 13 per cent considered that they had not been given the opportunity to ask questions or raise concerns. 8 per cent reported that they were ‘not sure/can’t remember’.

Most hub users surveyed considered that the Nurse engaged with their views on care and treatment

Clinical hub users surveyed were asked:

Did you feel the nurse discussed with you and was interested in your views concerning yours or the patient’s care and treatment?
Opinions of hub users surveyed on whether the Nurse engaged with their views on care and treatment

Over half (64 per cent) of hub users surveyed felt that the Nurse “definitely” discussed with them, and was interested in, their (the patient’s) views on care and treatment, while 21 per cent felt they did ‘to some extent’. 12 per cent felt that ‘no’ the Nurse did not discuss, or was not interested in their views of the patient’s care or treatment.

Clinical hub users generally agreed with the outcome of the clinical assessment

Clinical hub users surveyed were asked:

Did you or the person concerned agree with the outcome of the clinical assessment?
Agreement with the outcome of the clinical assessment, July 2014 – July 2015 (n=482)

The majority of clinical hub users surveyed agreed with the outcome of the clinical assessment with 65 per cent saying the definitely agreed and 21 percent reporting that they agreed with the outcome ‘to some extent’. Only 11 per cent reported that ‘no’ they did not agree with the outcome of the assessment.

As may be expected, the proportion of users that agree with the outcome of the clinical assessment is higher for incidents where an ambulance was sent (72 per cent reporting that they ‘definitely’ agreed with the outcome). The proportion of users reporting that they agreed with the outcome of the assessment is low for incidents where an ambulance was not sent but still over half, at 52 per cent. The proportion of users reporting they did not agree with the outcome of the assessment in incidents where an ambulance was not sent is almost double that of the overall average at 19 per cent.

Seeking post-call alternative care

The clinical hub users surveyed were asked whether they, or the person concerned had sought healthcare from someone else following their call to the clinical hub. As the chart below shows, of the 213 people who responded to that question, 68 per cent did seek post-call alternative care and 32 per cent did not. Of those that sought post-call care, most made their own way to the emergency department (31 per cent).
Whether patient sought post-call alternative care, July 2014 – July 2015 (n=213)

Low incidence of repeat calls about the same issue
Clinical hub users were also asked whether they had rung 111 again about the same issue within 48 hours, and if so, what the outcome of the call was. Only 14 per cent answered yes that they had called 111 again about the same issue within 48 hours. Of these (n=48), 71 per cent resulted in an ambulance being sent, and 29 per cent resulted in a reassessment being made by a clinical hub nurse.

Overall levels of satisfaction
Most clinical hub users were very satisfied with their experience
Clinical hub users surveyed were asked:

On a scale of 1-5, overall, how satisfied were you with your experience with the St John Clinical Hub?
The majority of survey participants (76 per cent) were satisfied with their experience of the clinical hub and over 50 per cent of respondents stated that they were “very satisfied”. Only 4 per cent reported being “dissatisfied” and 9 percent reported being “very dissatisfied”. 10 per cent were neutral regarding their experience of the clinical hub.

Whether the call resulted in an ambulance being sent or not does not seem to have had much of an impact on satisfaction. Reported satisfaction levels are only slightly higher in cases where an ambulance was sent (n = 2269) at 81 per cent (satisfied and very satisfied). Satisfaction levels are also only a bit lower in cases where an ambulance was not sent (n = 213) with 71 per cent of these respondents reporting they were either satisfied or very satisfied with their experience. Overall there is a 10 per cent difference in the “satisfied” and “very satisfied” responses between cases where an ambulance was sent compared to cases where an ambulance was not sent. clinical hub users were more likely to report being “very dissatisfied” or “dissatisfied” in cases where an ambulance was not sent (19 per cent in total).