



# Sensium<sup>®</sup>

Early detection of patient deterioration

Selected case studies

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# Introduction

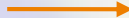





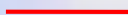
Sensium® is a discreet, wearable, wireless system for monitoring vital signs of patients outside of high acuity areas. By using a light comfortable sensor worn on the patients chest, Sensium® accurately and reliably monitors and reports heart rate, respiration rate and axillary temperature, providing data every two minutes. By notifying clinicians of changes in patients' vital signs, Sensium® brings the nurse to the deteriorating patient.

Working as your early warning system, Sensium® provides affordable real-time monitoring for your patients. You can be confident in the knowledge that the Sensium® system will notify you of vital signs outside of pre-defined limits suggestive of patient deterioration allowing intervention before the condition worsens, thereby improving patient outcomes, shortening hospital stays and lowering treatment costs.

Caregivers can conveniently view current values and trend history of patients' vital signs from any connected device within the hospital. If one or more of a patient's vital signs exceed a user defined threshold value for a set period of time, the Sensium® system can deliver notification messages to nursing staff via pagers, mobile phones and other handheld devices to warn them of adverse physiological incidents suggesting patient decline. The system thus enables caregivers to prioritise patient care based on their current condition and intervene earlier in the case of deterioration.

The following case studies have been collected during our early clinical deployments and are a fair reflection of the Sensium® system in use in busy clinical environments. They help to demonstrate the clinical effectiveness of the system at detecting and delivering notifications of potential patient decline. This can in turn lead to better patient outcomes and overall lowered treatment costs.

# Key for All cases studies

-  Sensium® **Notification**
-  Data from Clinical Notes
-  Heart rate per minute as measured by Sensium® also referred to as HR
-  Respiration rate per minute as measured by Sensium® also referred to as RR
-  Temperature in degrees Celsius as measured by Sensium® also referred to as Temp
- NEWS**  
National Early Warning Score - In the UK, the Royal College of Physicians has introduced a national early warning score as a guide used by medical services to quickly determine the degree of illness of a patient
-  Clinician defined Sensium® yellow notification limit
-  Clinician defined Sensium® red notification limit

# Sensium® - High Heart Rate Notifications, Pulmonary Oedema Diagnosed



## About the Patient:

An 81 year old female was admitted to the infectious diseases ward due to vomiting, reduced oral intake and diarrhoea.

The patient had been under the care of Oncologists with ongoing radiotherapy. A recent lower respiratory tract infection was treated with oral antibiotics.

## Ward rounds and NEWS:

Day 1 14:06 NEWS 5  
Day 1 16:42 NEWS 4

## Sensium® Notifications:

Day 1 00:11 Alert High HR 131  
Day 1 10:07 Alert High HR 135  
Day 1 15:29 Alert High HR 144

## Clinical Response:

Following doctor review at 15:30 on day 2 the patient was diagnosed with a pulmonary oedema. The trend screens supported this diagnosis for the patient as HR and RR were clearly erratic and unstable throughout this episode.

## Outcome:

The patient was discharged on day 3.



Sensium® Notification  
00:11 - Sustained high HR (131)

Sensium® Notification  
10:07 - Sustained high HR (135)

Sensium® Notification  
15:29 - Sustained high HR (141)

Ward Rounds and NEWS

14:06 NEWS 5 - Note the oscillatory nature of the HR trend which depending on exact time of observation round could lead to an artificially low NEWS value

Ward Rounds and NEWS

16:42 NEWS 5 - Again note the oscillatory nature of the HR trend

# Sensium® - Detects Sepsis, Sepsis Pathway Initiated



## About the Patient:

A 69 year old patient was admitted to the ward following a recent laparoscopic abdominoperineal resection for sigmoid colon cancer. The patient was 4 days post op and on a 4 hourly manual observation regime.

## Ward rounds and NEWS:

Day 4 16:01 NEWS 2  
Day 4 20:08 NEWS 6

## Sensium® Notifications:

Day 4 17:39 Alert High RR 26

## Clinical Response:

Following the Sensium notification for high HR the trend screens for the patient were reviewed and the sepsis care pathway was initiated.

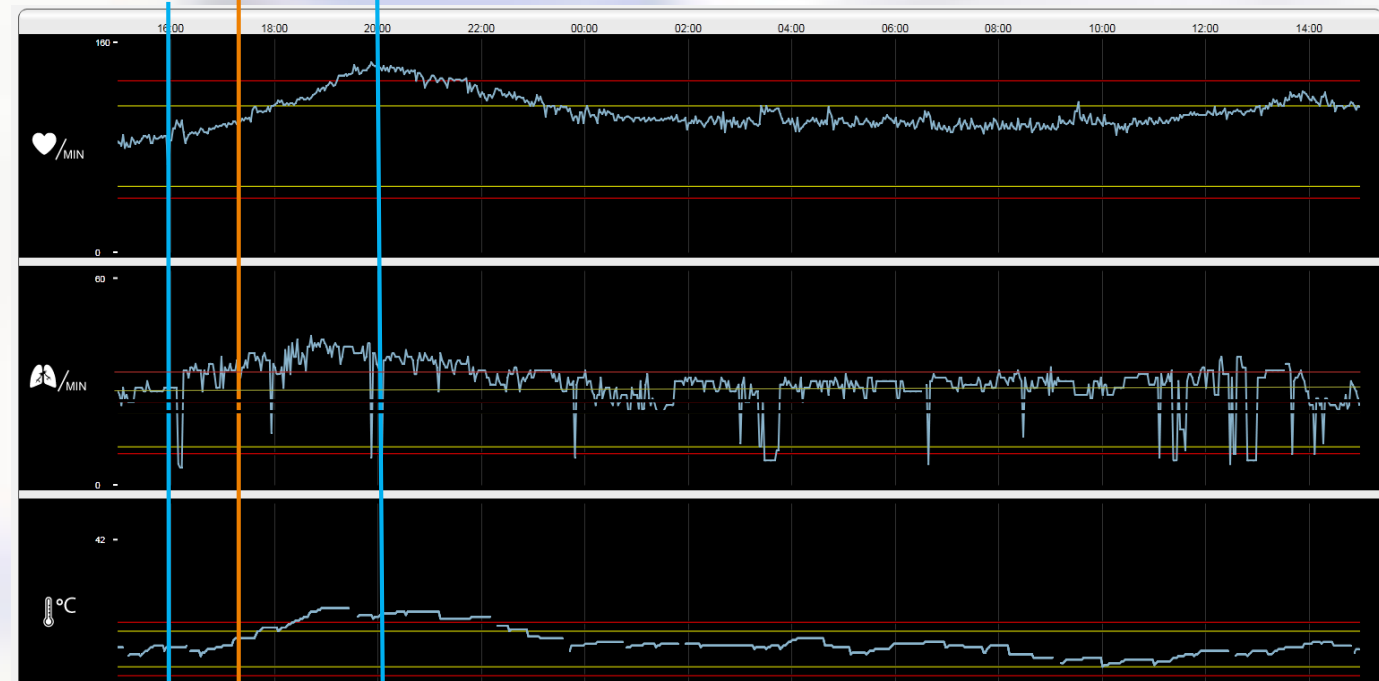
The Sensium notification occurred over 2 hours before the next set of scheduled observations and as such the patient was able to be treated on the ward without having to be escalated to a higher acuity treatment area.

## Outcome:

The patient stabilised and was later discharged home.

Sensium® Notification  
17:39 - Sustained high RR  
(26)

**Note:** HR RR and temp all started to deviate at approx. the same time this provided the clinicians with the information that they needed to initiate the sepsis care pathway more than 2 hours before the next set of scheduled observations



Ward Rounds and  
NEWS  
16:01 NEWS 2

Ward Rounds and  
NEWS  
20:08 NEWS 6

# Sensium® - Detects Opioid Induced Respiratory Depression

CASE  
STUDY

## About the Patient:

A 65 year old male patient was transferred from the critical care unit to a side room in the general surgical ward. The patient was 2 days post laparotomy for subtotal colectomy and on a 4 hourly observation regime.

## Ward rounds and NEWS:

Day 3 03:58 drugs round, morphine  
Day 3 05:32 Low O2 saturation

## Sensium® Notifications:

Day 3 05:21 Alert Low RR 7

## Clinical Response:

The patient was administered prescribed morphine for the management of post operative pain. The nurse continued with her drugs round and 90 minutes later received a notification for sustained low RR.

Upon review it was confirmed that the patients oxygen saturation was low and the patient was noted as being drowsy. Opioid induced respiratory depression was suspected and the patient was escalated to the surgical team. Naloxone was prescribed to counter the effects of morphine.

## Outcome:

The patient was in a single side room and incapable of calling the nursing staff. The Sensium notification brought the nurse to the patient 2.5 hours earlier than the next set of scheduled observations. If left untreated for longer this episode of opioid induced respiratory depression could have had profound and severe consequences for the patient.



**Drug Round**  
Morphine administered for post operative pain management

**Observations**  
05:32 Patient drowsy, Oxygen saturation confirmed low, escalated to surgical team

**Note:** 06:32 Naloxone administered to counter act the effects of the prescribed morphine.

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# Sensium® - Detects Opioid Induced Respiratory Complication

CASE  
STUDY

## About the Patient:

A 72 year old patient was on the ward 12 hours post partial knee replacement surgery. The patient was on a 4 hourly observation regime. The patient in the past had suffered mild obstructive sleep apnoea (OSA).

## Ward rounds and NEWS:

Day 1 22:40 Patient Stable

## Sensium® Notifications:

Day 1 22:32 Alert High RR 21

Day 1 22:55 Alert High RR 22

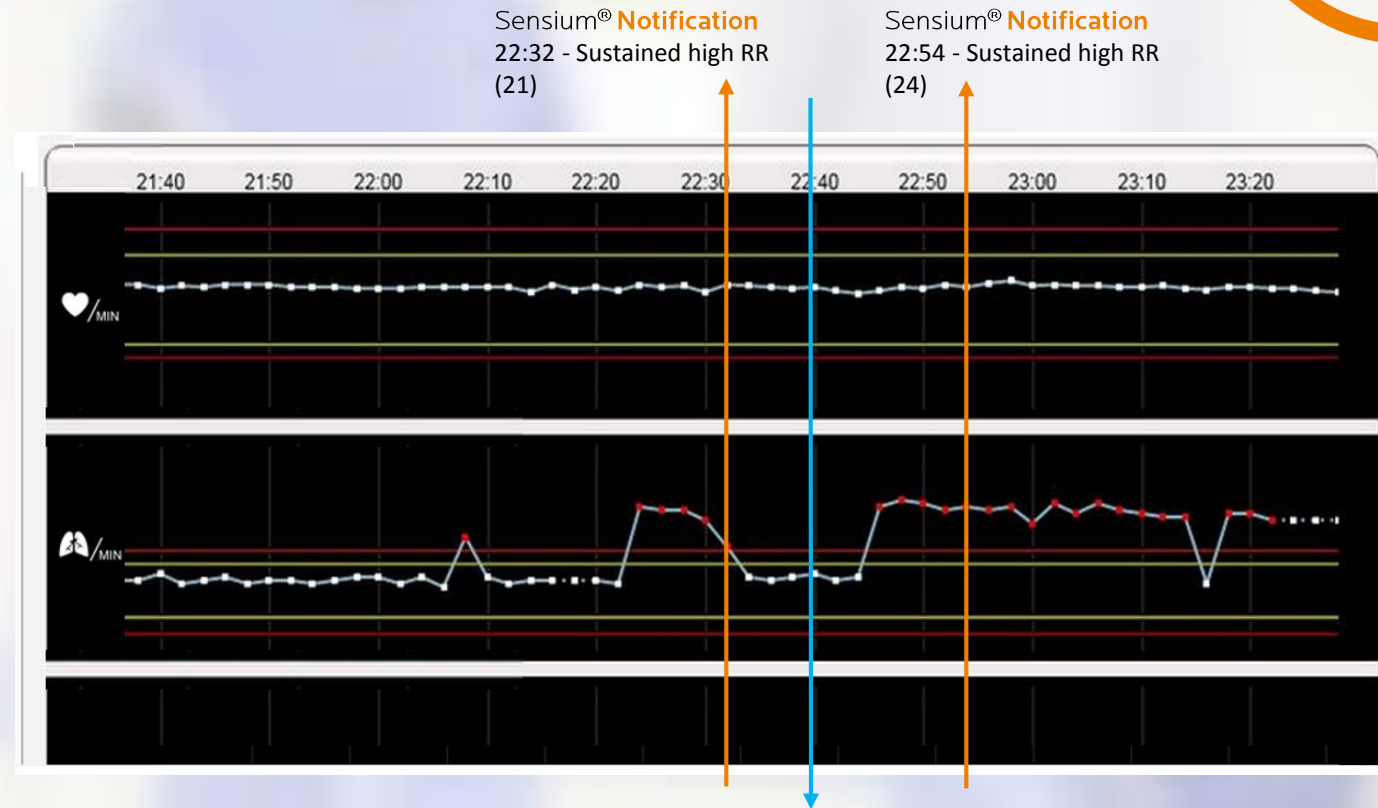
## Clinical Response:

The nurse was notified of a sustained high RR and went to assess the patient. On review the patient was noted as being asleep and stable. From the trend screen it is evident that the patient's episode of hyperventilation had abated by the time the nurse reached the patient.

The nurse then received a second notification for high RR. The patient was now noted as in respiratory distress and escalated to the surgical team. OSA exacerbated by effects of anaesthetics and any postoperative analgesia was suspected.

## Outcome:

This episode of respiratory distress may have gone unnoticed for another 2.5 hours until the next set of scheduled observation. As the effects of anaesthetics wore off the patient's condition stabilised.



Ward Rounds and NEWS  
Patient noted as being asleep  
and stable

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# Sensium® - Detects Tachycardia, Fast Atrial Fibrillation Diagnosed

## CASE STUDY

### About the Patient:

A 65 year old male patient was on a post surgery ward and was 4 days post colorectal surgery. The patient had a suspected infection which was being managed using IV antibiotics, IV paracetamol and daily bloods/blood cultures. Clinical staff were aware of the patients elevated temperature.

### Ward rounds and NEWS:

Day 4 06:11 Temp 38.4°  
Day 4 07:15 High HR confirmed,  
12 lead ECG ordered  
Day 4 09:01 IV Digoxin

### Sensium® Notifications:

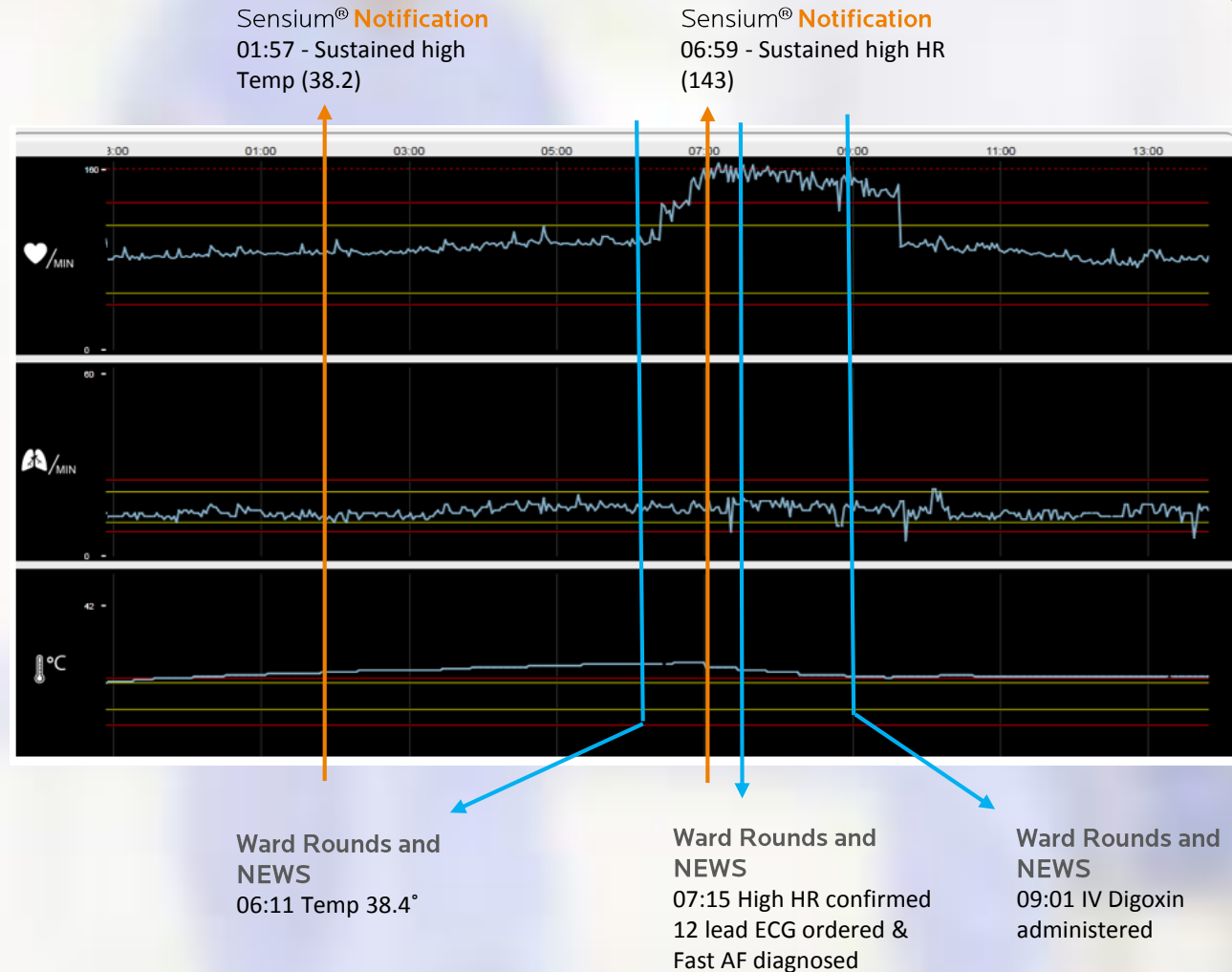
Day 4 01:57 Alert High Temp 38.2°  
Day 4 06:59 Alert High HR 143

### Clinical Response:

The nurse responded to the high HR notification by manually checking the HR and escalating to a senior clinician. The doctor ordered a 12 lead ECG, confirmed a fast AF diagnosis and prescribed IV Digoxin to stabilise the patients erratic heart rate. The effectiveness of the treatment was then monitored using the Sensium trend screen

### Outcome:

Sensium first notified of this patients high HR 45 minutes after a previous observation round, 3 hours and 15 minutes before the next scheduled observation round. The patients condition stabilised and he was later discharged home.



**Note:** After Digoxin was administered the heart rate settled and was monitored using the Sensium trend screen

# Sensium® - Detects Tachycardia Episode Between Observation Rounds



## About the Patient:

A 79 year old male was admitted to the infectious diseases ward after being discharged home after a haematology day case following a blood transfusion. The patient became unwell in the ambulance and a temperature of 39.5° and confusion was noted.

Past medical history includes multiple myeloma and renal end organ damage

## Ward rounds and NEWS:

Day 1 05:53 NEWS 1  
Day 1 08:47 NEWS 0  
Day 1 14:26 NEWS 1  
Day 1 23:45 NEWS 1

## Sensium® Notifications:

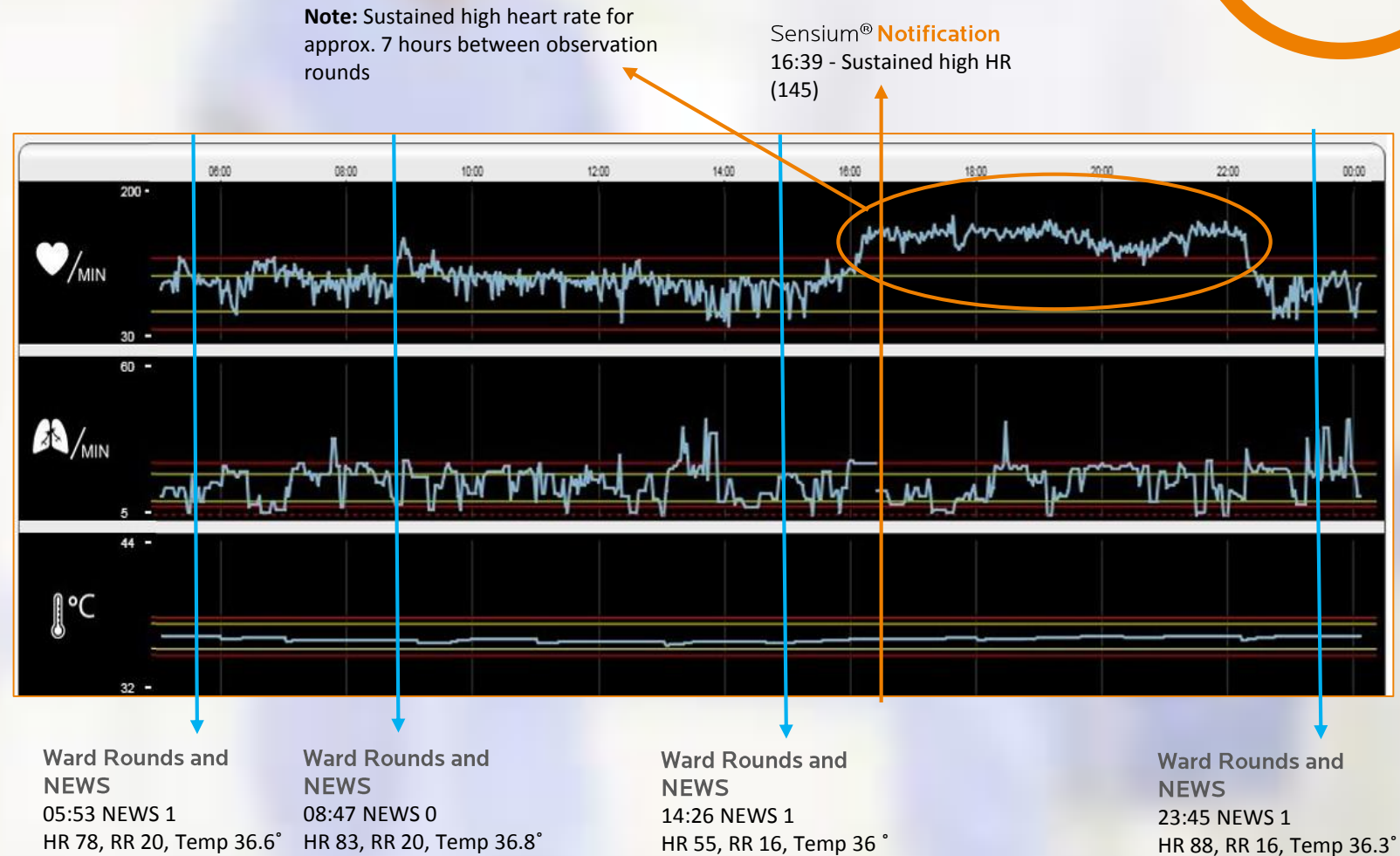
Day 1 16:39 Alert High HR 145

## Clinical Response:

The instance of tachycardia for this patient is significant as it was prolonged and happened between observations rounds. If this were to happen in a lower acuity environment the outcome for the patient could have been quite different.

## Outcome:

Day 3 patient discharged home.





# Sensium® - Detects High Temperature, Meningitis Diagnosed

CASE  
STUDY

## About the Patient:

A 66 year old male was admitted to the medical ward with a suspected infection of unknown origin. The patient was being treated with 500mg paracetamol every 4 hours.

## Ward rounds and NEWS:

Day 1 Patient being treated with paracetamol

## Sensium® Notifications:

Day 1 04:05 Alert High Temp 38.2°

## Clinical Response:

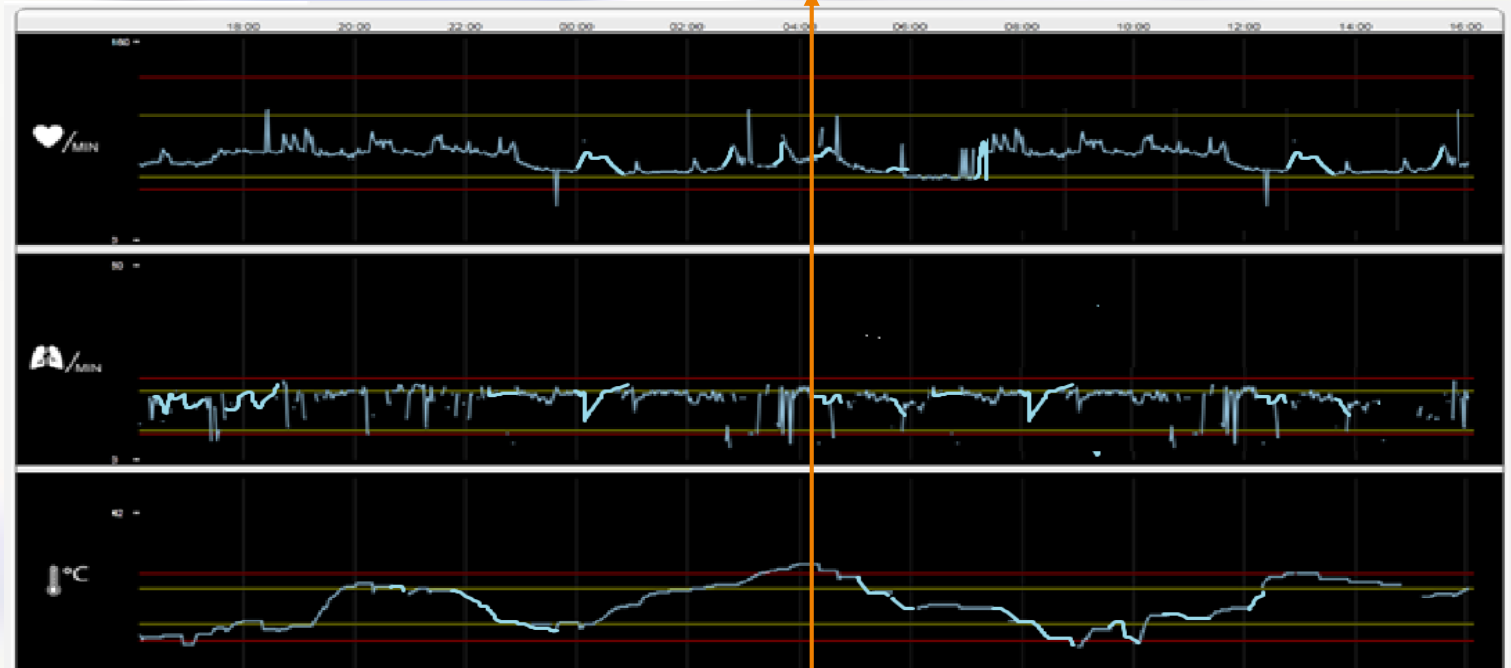
The patient's temperature can be clearly seen to be cyclical coinciding with the paracetamol. The patient's vitals trend data was reviewed in the morning and Sepsis was suspected with IV antibiotics prescribed.

The effectiveness of the antibiotics was monitored using the trend screen and was found not to control the patient's temperature as expected. Based on this further investigations were ordered and a later Lumber puncture confirmed a diagnosis of meningitis.

## Outcome:

The patient was treated and was discharged home.

Sensium® Notification  
04:05 - Sustained high Temp (38.2°)



**Note:** the oscillatory nature of the patients temp coinciding with the administering of 500mg of paracetamol every 4 hours

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# Sensium® - High Heart Rate & Temp Notifications, Corroborated by Observations



## About the Patient:

65 year old female was admitted to the ward due to shortness of breath and feeling unwell. Past medical history included Pulmonary Fibrosis (on home O2 10L), Type 2 Diabetes, RBBB (right bundle branch block), CKD stage 3, and previous breast cancer

## Ward rounds and NEWS:

Day 1 15:31 NEWS 8 (HR 119)  
 Day 1 16:02 NEWS 5 (HR 119)  
 Day 1 18:31 NEWS 5 (HR 106)  
 Day 1 20:18 NEWS 8 (36.4°)  
 Day 1 20:50 NEWS 9 (38.3°)

## Sensium® Notifications:

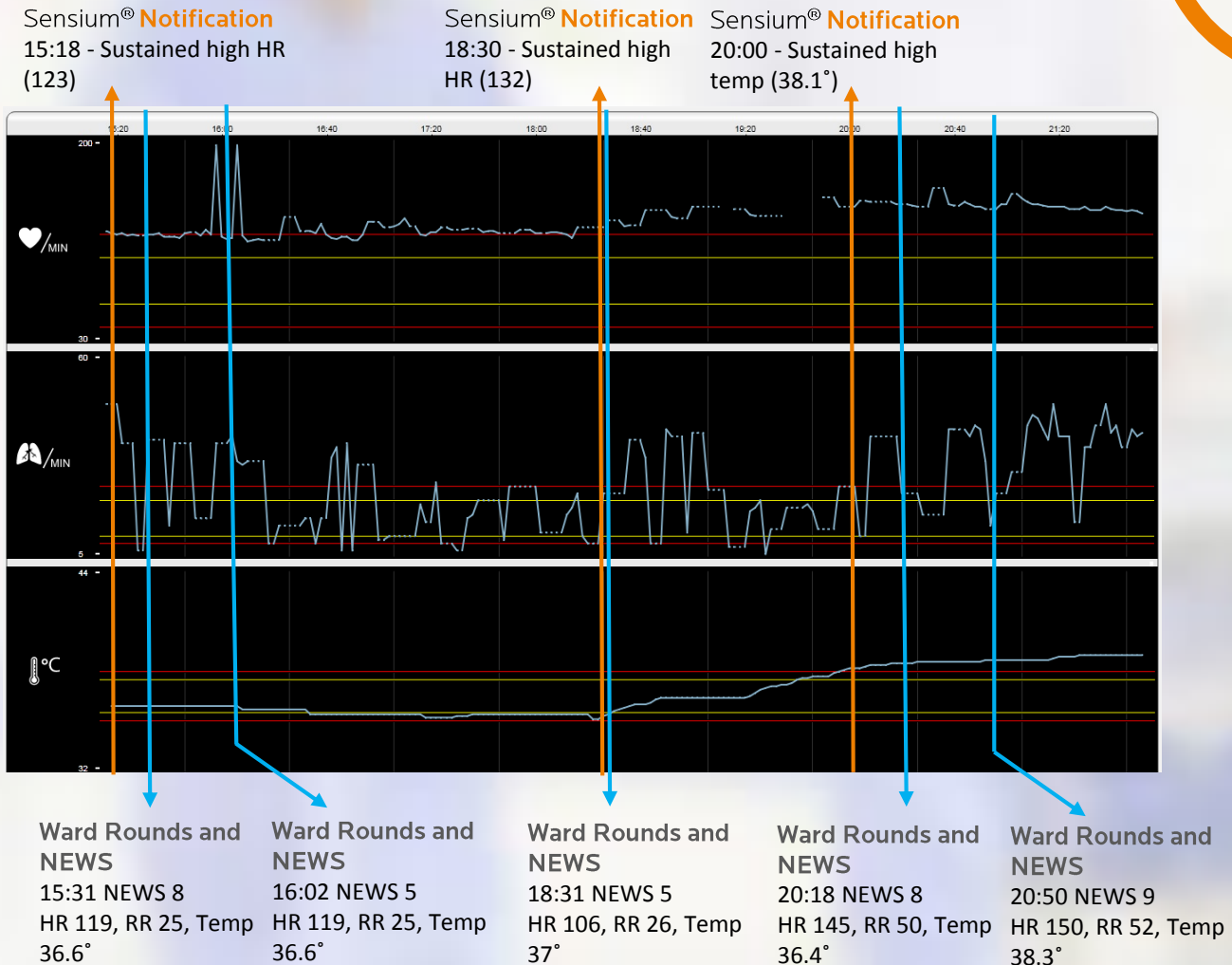
Day 1 15:18 Alert High HR 123  
 Day 1 18:30 Alert High HR 132  
 Day 1 20:00 Alert High Temp 38.1°

## Clinical Response:

The nursing staff received Sensium notification on 3 occasions and responded with a full set of manual observations. Notifications accuracy was corroborated with these manual readings.

## Outcome:

Sensium proven as effective clinical decision Support tool.





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