Approved by Quality & Patient Safety Committee
18/7/13

NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE

1) INTRODUCTION
The benefit of Non Invasive ventilation (NIV) is to enable ventilatory support without the need for intubation. Patients find the therapy and mask comfortable, it is portable and women are able to receive this treatment intermittently and can communicate between times off the machine. NIV is pressure ventilation delivered as BiPAP (two levels of ventilatory support) known as Inspired positive airway pressure (IPAP) and expired positive airway support (EPAP). One level of support can also be delivered which is delivered as EPAP or CPAP which is delivered throughout the respiratory cycle.

The aim is to maintain adequate ventilation and minimize the effort of breathing.

2) DESIGNATED AREAS FOR BIPAP
All patients needing NIV will require admission to Acute Care for closer haemodynamic monitoring and higher acuity nurse/patient ratio. Staffing will be arranged by the Nurse Manager if short term NIV is required in Recovery for the postoperative woman.

3) STAFFING REQUIREMENTS
Patients for NIV are nursed 1:1 on commencement of ventilation and can be nursed 1:2 once stable.

4) STAFF COMPETANCE
Staff are to attend a competency assessment prior to caring for a patient on NIV- see Appendix 3.

5) INFECTION CONTROL
Standard precautions are required when handling the NIV equipment. If waiting determination or uncertain of the patient's respiratory status consideration should be given to whether the woman is placed into a negative pressure room and respiratory precautions instituted.
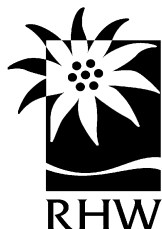
6) RESPIRONICS V60 VENTILATOR
This machine is currently used for NIV in ACC. See Appendix 1 for definitions of settings and Appendix 2 to guide the setup of the circuit. The machine is powered by AC power and has an internal battery which can be used in power failure or inter hospital transfers. The battery fully charged will last for 6 -8 hours. When not in use the V60 machine should remain plugged into the electricity. T he machine manual is stored under the machine.

7) DEFINITIONS

NON INVASIVE VENTILATION- NIV is ventilatory support via a face mask.

BILEVEL POSITIVE AIRWAY PRESSURE (BIPAP)-is non invasive Bi-level positive pressure ventilation (two levels). The machine provides positive pressure support ventilation by mimicking normal ventilation patterns with changes in inspiratory and expiratory pressures (IPAP > EPAP).

INSPIRATORY POSITIVE PRESSURE (IPAP)-is titrated to maintain tidal volume, support ventilation and reduce the work of breathing and thereby reducing C02 retention.

ROYAL HOSPITAL FOR WOMEN

LOCAL OPERATING PROCEDURE

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EXPIRED POSITIVE AIRWAY PRESSURE (EPAP) - is titrated to eliminate upper airway obstruction and prevent end expiratory collapse of airways, thereby maintaining or improving oxygenation.

CPAP- is positive airway pressure ventilation therapy delivered throughout the respiratory cycle to spontaneous breathing patients. A nominated pressure splints the airway opened throughout the respiratory cycle thereby maintaining oxygen saturation, functional residual capacity and preventing alveolar collapse.

8) INDICATIONS FOR NIV
- Atelectasis
- Muscle fatigue
- High C02 respiratory failure with moderate to severe dyspnoea
- Ph<7.35 or PaC02 >45mmHg,Pa02 <60mmHg,RR>24 bpm
- Use of accessory muscles for breathing
- Hypoxemia
- Alveolar hypoventilation
- Lung disease eg CAL
- Fluid overload

9) PRIOR TO COMMENCING
It is important that the following criteria be met before starting patients on NIV:
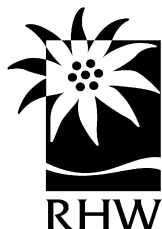- The patient is haemodynamically stable, conscious and breathing spontaneously.
- The patient is not nauseous or vomiting and must have an adequate gag and cough reflex.
- The patient must be cognitively aware so that he or she knows if and when the mask needs to be removed.
- The mask is fitted correctly using the provided template on the setup packaging so that an adequate seal can be maintained.

10) CONTRAINDICATIONS TO NIV
- Patients documented "Not for resuscitation" or has a decreased level of consciousness
- Patients who have had a recent pneumothorax or recent lung resection or excessive respiratory muscle fatigue.
- Patients with a decreased level of consciousness
- Facial trauma
- Any indication for endotracheal intubation.

11) INITIATING NON INVASIVE VENTILATION
- The order is written by the Anaesthetic Fellow or Physician in the patient's integrated notes and the prescription is documented on the Ventilation Assistance Chart.
- Prescribers orders are written every 24hours with goal Sa02 and frequency on and off machine as per prescription chart.
- All circuits and water for Irrigation is located in the storeroom top shelf.
- There is a setup guide attached to the machine and in Appendix 2 (slides). If you have any problems with the setup ring ICU, the CNC ACC or the Respironics rep to clarify your query.

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NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

- Patients require a high level of psychological preparation and support during the initial stages of non-invasive ventilation. To relieve some of this anxiety an explanation of the following is required:
  o the purpose of the ventilation
  o the expected duration of therapy and time on and off therapy.
  o the mask and the quick release clips.
  o the importance of keeping the mask on..
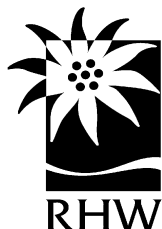 o on the noise of the machine and on the high flow of air onto the face.

An education resource on NIV is given to the patients prior to initiating BiPap or when feeling well enough to read it.

12)   MONITORING
- Attach pt to ECG and O2 saturation monitor and set alarms on the spacelab monitor.
- Record baseline RR, BP, HR, Sa02 observations and take observations 5 minutely for 15 minutes (due the initial effects of positive pressure ventilation on the cardiovascular system) then hourly after commencement of NIV.
- Whilst on NIV the nurse is required to stay with the patient in case of deterioration or to troubleshoot machine alarms.
- 02 sats must remain above 92% unless otherwise specified by the Anaesthetist.
- Hourly observations are required once the patient is stable and documented on the HDU observation chart. Al other observations are recorded on the Ventilatory Assistance Chart
- +/- baseline CXR to diagnose condition and exclude a pneumothorax
- +/- baseline ABGs to determine the need type of ventilation and to provide baseline data for comparison of effectiveness of treatment
- Position patient upright or when well enough sit out of bed to maximize oxygenation
- Encourage deep breathing and use of triflow during breaks from the therapy.
- Promote rest once stable

13)   MASK FIT
- Choose mask according to sizing template on disposable setups.
- The mask should fit comfortably on the pts nose not occluding the nares and the base of the mask should fit comfortably between the chin and bottom lip see picture on setup guide.
- Headgear should fit comfortably not tight. The bottom edge of the headgear should sit at the base of the nape of the neck with side straps underneath the earlobes.
- The face masks are better for patients who are dyspnoeic and tachypnoeic as they tend to mouth breathe with a nasal mask and reduce the effectiveness of the ventilation. Masks that are too tight are uncomfortable and cause pressure areas and masks that are too loose leak which reduce the efficiency of the system.
- When using a nasal mask the patient must keep their mouth closed to obtain the desired effect of the ventilation.
- Apply a skin protectant to the bridge of the nose to protect the skin.

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NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

14)   COMMENCING NIV
- Set up machine circuit using disposable mask and circuit setups only. Ensure that there is always an exhalation port at the base of the mask for C02 to be expired..
- Set mode and settings as per Drs prescription on Ventilation chart.
- See Appendix 1 for definitions of all modes, usual and alarm settings.
- Set Alarms on machine-see usual alarm settings and check alarm settings with Anaesthetist.
- Turn on machine and gently hold mask over nose/face until patient becomes accustomed to the airflow. Attach the head strap. Stay with patient until the 02 saturations and observations are stable.
- Return ventilation to 02 mask if there is any deterioration of observations and have patient reviewed.

Monitor patients response for:
- Decreased HR, RR, BP
- Decreased sweating
- Decreased work of breathing (as per baseline observations)
- Patient feels more comfortable
- Patient finds it easier to breathe

15)   ONGOING CARE
- Alert Anaesthetist to abnormal observations and signs of failure of therapy i.e
- increasing respiratory effort, worsening agitation, sweating, inability to clear
- secretions, inability to accept face mask/nasal mask, haemodynamic instability or
- decreasing 02 saturations.
- Repeat ABG as ordered or if clinically indicated.
- Insert arterial line if frequent ABGS are required
- Adjust pressures according to Anesthetists' orders.
- Observe for signs of gastric distension, upper airway obstruction and vomiting
- Review re need for a NGT.
- Remove mask 2nd hourly/prn for regular mouth care, skin assessment and facial
- care.
- Patients receiving supplemental oxygen while on NIV will require supplemental
- oxygen via mask when not on NIV. Supplemental oxygen may need to be increased
- to maintain prescribed SpO_2 levels while not on NIV.

16)   FAILURE OF NIV SHOULD BE SUSPECTED IF;
- The patient is unable to maintain adequate oxygenation, decreasing 02 saturations despite increases in 02. There is a reduction in neurological or conscious state
- the patient has excessive secretions or increasing respiratory rate.
- failure of PaCO2 or PH to improve on ABG sample
- Poorly compliant lungs

An anaesthetic review and possibly an ICU referral will be required if the patients condition meets any of the above criteria. An ICU review is obtained by the Anaesthetic fellow calling POWH ICU on ext 24701.

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NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE   cont'd

17)   NEBULISERS
- In line nebuliser can be attached to the base of the face mask using a white piece located with the NIV equipment.
- Insert medication into nebuliser bulb and attach to T-piece.
- Use T-piece nebuliser placed between the mask and inspiratory tubing. The nebuliser needs to be held upright to nebulise adequately. Inhalation medication -has a greater distribution if given while patient is on NIV. Use air for nebulisation unless patient requires> 6 l/min O_2
- An increase in supplemental O_2 may be required if SpO_2 decreases from the additional air diluting the concentration of inspired oxygen.

18)   WEANING OR CESSATION IF NIV;
- Normalization of PaC02 and maintaining O2 saturations with minimal oxygen
- Reduction in respiratory rate
- Intolerance of NIV
- Reduced dyspnoea
- Normal overnight ventilation
- Patients receiving palliative treatment
- Many patients will need only 4-24 hours of continuous NIV and thereafter intermittent
- or nocturnal support.

A guide for weaning as tolerated by the patients respiratory status is:
- Remove NIV for more frequent periods during the day. Encourage use when –
- patients are resting, after exertion, or sleeping.
- Use NIV at night only.
- Cease NIV as per Drs orders.
- Record in patients notes.
- If the IPAP mode is inappropriate the IPAP may be reduced towards the EPAP
- value to reduce level of support. Oxygen is weaned as ordered.

19)   CLEANING
- Discard disposable bacterial filter, mask and tubing in general waste.
- The bacterial filter encased on the side of the machine requires replacement when discoloured.
- Wipe over machine and trolley with neutral detergent.

20)   TRANSFERS
- the V60 machine has an internal battery and fully charged will last 6-8 hours.
- it will be decided by the Anaesthetist whether the patient requires transfer using NIV or oxygen via the mask. If the patient is on greater than or equal to 70% 02 determination whether it is safe to transfer due to amount of 02 required on transfer or if retrieval by ICU staff is required.
- For all transfers to ICU an Anaesthetist, Nurse and porter will escort the patient.
- Two full 02 cylinders will be required for transfer.
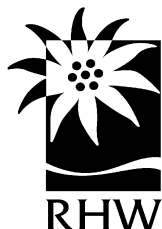
NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE   cont'd

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Murray, S.2002 Bi-level positive airway pressure (BiPAP) and acute cardiogenicpulmonary oedema (ACPO) in the emergency department. *Aust Crit Care* 15 (2):51-63
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failure. *Thorax57:192-211*

REVISION & APPROVAL HISTORY
Endorsed RHW Operating Theatre Committee July 2013

DEFINITIONS AND USUAL SETTINGS

Settings	Settings Active in CPAP	Settings Active in BiPAP	Description	Range	Usual setting used in ACC
CPAP MODE	●		Continuous Positive Airway Pressure	4-25 cm H20	8-14
S/T or BiPAP MODE		●	Spontaneous Timed or BiLevel Positive Airway Pressure Ventilation. Two level system of alternating during non invasive ventilation in sync with breathing-set IPAP and EPAP	-	-
EPAP	●	●	Expired Positive Airway Pressure. Recruits under ventilated alveoli to remain open during expiration by providing a constant pressure throughout resp cycle. Must be less than or equal to IPAP	4-25 cm h2o	5-14
IPAP		●	Inspired Positive Airway Pressure provides pressure throughout the inspiratory phase to support pt ventilation	4-40 cm h20	10-20
I-time		●	Inspiratory time- time taken to inspire in seconds	0.3-3.0 s	1:3
Fi02	●	●	Oxygen delivered	21-100%	As ordered
Ramp time	●	●	The Ramp Time function helps your pt adapt to ventilation by gradually increasing inspiratory and expiratory pressure over a set interval (minutes). This time gradually delivers pressures so to reduce pt anxiety and increases comfort.	OFF or 5-45 min	10 mins
Rate (resp rate)		●	Pts respiratory rate	4-60BPM	4
Rise time		●	Speed at which the inspiratory pressure rises to the set pressure.	1-5 (1 is the fastest)	Set at 3

Patient Data

Data	Description	Range	Usual setting in ACC
Breath phase/trigger Indicator	Bar in left hand corner. Coloured according to breath trigger.	n/a	**n/a**
PIP	Positive Inspiratory pressure	0-50	**n/a**
Patient total leak	Est or unintentional leak	0-200L	**n/a**
Patient trigger	Pt triggered breaths as a percentage	0-100%	**Should be 100%**
Respiratory Rate	Respiratory rate	0-90 BPM	**n/a**
Ti/Ttot	Inspiratory duty cycle or inspiratory time divided by total cycle time	0-91%	**n/a**
Minute Volume	Est minute ventilation. TV x rate=MV	0-99l/min	**n/a**
Tidal volume	Est. expired tidal volume	0-3000 ml	**n/a**

Alarms

Alarm	Description	Range	To set as per policy
Hi Rate	High respiratory rate alarm	5-90 BPM	10 breaths above pts own
Low Rate	Low respiratory rate alarm	1-89 BPM	5 breaths below its own
Hi VT	High tidal volume alarm	200-2500 ml	200 ml above pts own
Low VT	Low tidal volume alarm	OFF-1500 ml	OFF
HIP	High inspiratory pressure alarm	5-50 cm H20	10cm above IPAP
LIP	Low inspiratory pressure alarm	OFF, 1-40 cm H20	OFF
Lo VE	Low minute vent alarm	OFF, 0.1 to 99L/min	OFF
LIP T	Low inspiratory delay time	5-60 secs	5 secs

CPAP settings
- Set CPAP level as ordered

- Set 02 as ordered

- Set Ramp time as ordered
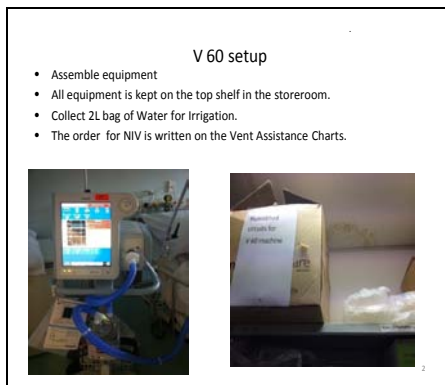
- Set C-Flex at 3

BiPAP settings
- Set breath rate as ordered

- Set I-time as 1.3

- Set EPAP as ordered

- Set IPAP as ordered

- Set rise time as ordered

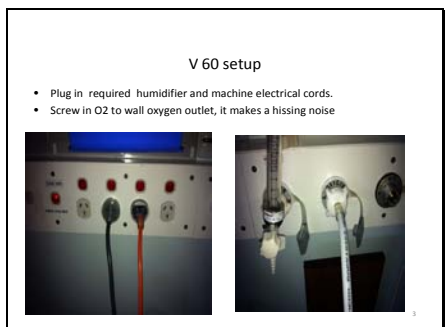- Set 02 as ordered and ramp time as ordered

Set up

Slide 1

Slide 2

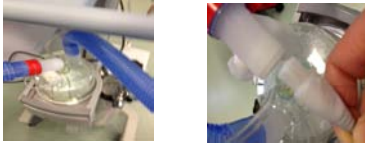lide 3

Slide 4

Install circuit

Connect tubing and filter to outlet and then clip in humidifier. Add second inspiratory line. **Connect grey humidifier lead to tubing for warming of inspired air.**

Slide 5

Important: ensure the connections are placed correctly.

Connect humidifier to circuit by inserting grey lead into 3 leaf clover connection

C Molihan CNC ACC

Slide 6

Humidification of Circuit

Connect drip spike into bag of water for irrigation-it will fill itself to the black line. Check hourly during use.
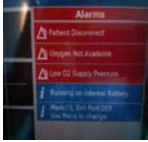
C Molihan CNC ACC

Slide 7

V 60 setup

Ensure proximal pressure tubing is connected to prox. pressure port

Ensure humidifier is connected to circuit and light is on. Turn on and adjust humidifier temp to low medium or high.

Slide 8
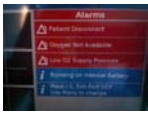

Correct mask and exhalation port

- Ensure that the mask has no. 1 on the base and there is an exhalation port in place which is noted in messages as Exh Port: DEP
- To change these settings go to Menu window, select mask/Port
- Select no. mask and accept. This would be **an unusual** occurrence as we only have the one type of mask and this setting shouldn't need changing.
- Select desired exhalation port type and accept. This should always be DEP (disposable exhalation port) and we have only one brand of setup.

Slide 9

Alarms

- Alarms and messages alert you to situations that require your attention.
- Always respond immediately to an alarm. **Firstly ensure sufficient and effective ventilation for pt and then silence the alarm**
- Correct the alarm condition.
- Information messages- are on a blue background,
- Red message- HIGH PRIORITY- respond immediately- correct condition or place pt on 02 mask whilst troubleshooting.
- Yellow message-LOW PRIORITY- respond promptly correct condition or place pt on 02 mask whilst troubleshooting.

Slide 10

Mask fit- the mask sits comfortably on the bridge of the nose and under the bottom lip.

Measure face with mask measures to select correct size mask- a well fitted mask is the key to successful compliance and therapy.

The full face mask minimises facial pressure while maintaining a good seal, even on the sensitive nasal bridge. By easily adjusting the mask force at the bridge of the patient's nose, you can achieve the comfortable fit to enhance ventilation therapy.
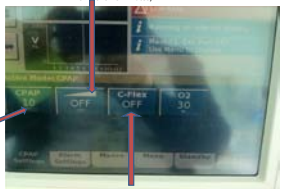
This is a small mask.

Mask no. 1 and machine set and mask has DEP (disposable end port) insitu.

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Slide 11

CPAP settings

Time the machine takes to increases pressure which helps to reduce anxiety (set at OFF or 5-45 minutes)

CPAP- continuous positive airway pressure

Reduces pressure at beginning of exhalation- a time when pts may be uncomfortable with CPAP. The higher the setting the greater the relief (1,2, or 3). See page 6-15 in manual.

Slide 12

BiPAP settings

- IPAP-the application and maintenance of pressure above atmospheric throughout the inspiration phase of breathing (4-40)
- EPAP-the application of and maintenance of pressure above atmospheric throughout expiration (4-25)
- I-Time-time to deliver required gas (normally set-1.3-1.5)
- Rise-speed at which the inspiratory pressure to the set target pressure (1-fastest, 5-slowest)
- Ramp-Interval which the machine gradually increases pressure to reduce pt anxiety (OFF 5-45 mins)

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Slide 13

Patient

TV-estimated exhaled tidal volume averaged over last 6 breaths.

Peak Inspiratory pressure- the highest pressure during the previous pt breath (should be approx the same highest dialled pressure see -10 IPAP, PIP)

Rate-respiratory rate

Est. minute volume- TV x RR averaged over last 6 breaths.

Coloured Bar indicates machine breath delivered or pts breath taken.
Sky blue-spontaneous pt breath
Orange-Timed machine breath

Patient data documented hourly

Pt leak-Est. pt leak or unintentional leak. Approx.7-25L.

Waveform window

% pt triggered breaths over last 15minutes

P- airway pressure
V-Total flow
minus leak
V-est. pt volume

Inspiration divided by total cycle time

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Slide 14

Alarm settings

High exhaled tidal volume- will alarm if goes above this (200-2500 mls)

High pressure in pt airway- 5-50cms h2o.

Low Insp minute volume OFF-99.0 L/min

Upper breath rate limit- will alarm if pts breath rate goes above this (5-90)

Lower breath rate limit- will alarm if pts breath rate goes below this (1-89)

Interval till machine detects low pressure 5-60secs (mouthwash-sip of h2o)

Low pressure in pt airway OFF-40cms h20)

Low exhaled tidal volume-will alarm if goes below this set TV (OFF-1500mls)

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Slide 15

Transferring patients

- For transfers the battery life is between 6-8hours and a gauge will show up on the right bottom hand corner of the screen with time remaining.
- Ensure that you have two full 02 cylinders when transferring pts. Connect the 02 cable to the 02 outlet on the 02 cylinder.

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Slide 16

Contacts

If you need any assistance do not hesitate to contact;
- Louise Bucke Rep 0408244100
- Catherine Molihan CNC ACC 0419256522
- ICU ext. 24701

ACC Non Invasive Positive Pressure Support Competency		
COMPETENCY	**Expected Performance**	**Actual Performance**
Demonstrates knowledge of the practical use of NIV.	1. Able to locate equipment. 2. Understands indications of Using the two different circuits. 3. Sets up V60 machine circuit using humidification circuit. 4. Is able to explain the differences of each mode. 5. Understands principles and importance of correct mask fit and sizing 6. Correctly locates the NIV protocol, V60 manual and setup guide. 7. Correctly demonstrates how to put humidification into circuit:- uses water, aware of how frequently to change circuit (weekly). 8. Understands all functions and changing parameters, TV, MV, C-flex, Ramp, Rise etc 9. Aware Anaes to check set alarms	
Understands required monitoring	1. ECG,HR, o2 sats, RR, BP and vent chart documentation 15mins then hrly 2. ABG/CXR when required 3. Ventilation chart prescription.	
Demonstrates an understanding of the pathophysiological effects of BIPAP.	1. Describes action of BIPAP:- increases tidal volume and hence ventilation, reduces work of breathing, PEEP prevents airways collapsing at the end of expiration. 2. States contraindications:- pneumothorax, reduced consciousness (lower than GCS 8), risk of vomiting, no gag reflex, head or facial trauma, excessive secretions.. 3. Aware that PPS is IPAP-EPAP, the pressure above EPAP pressure. Is aware that IPAP changes will affect the PCO2, that EPAP or inspired O2 will affect the PO2.	
Demonstrates an understanding of the pathophysiological effects of CPAP.	1. Describes action of CPAP:- increases functional residual capacity, increases lung compliance, reduces work of breathing, recruits collapsed alveoli, improve gas exchange. 2.Understands contraindications of using NIV.	
Understands signs of deterioration and process to escalate care.	1. Decreasing 02 sats increasing 02 to maintain saturations as ordered. 2. Understands the referral process- Anaes- ICU referral. 3. Understands battery life and able to demonstrate connection to portable 02.	
Demonstrates an understanding of cleaning procedures and disposal of equipment.	1. Aware of what equipment is disposable and machine is lightly wiped over after use and stored connected to power .	
Read policy and viewed DVD		