Scenario Overview

The environment exposure scenario simulates the physiology of an adult woman who is exposed to cold weather long enough to develop hypothermia. This scenario highlights the ability of the BioGears® physiology engine to siimulate physiology when the body is exposed to an abnormal environment.

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|--|--|--|---|--|--|--|--|--|--|--|--|--|
| Base Physiology | Insults and injuries | Assessments | Interventions | | | | | | | | | |
| A 17 year old female with no prior history. | Cold weather exposure | Core Temperature Skin Temperature Heart Rate Respiration Rate | Removal from environment Active heating Increase clothing | | | | | | | | | |
| Segment 0 | Engine initialization period | Scenario Narra | ative | | | | | | | | | |
| Segment 0 | Engine initialization period. | • | | | | | | | | | | |
| Segment 1 | A 17 year old female leaves her Alaskan home in the middle of winter to retrieve a newspaper. She is wearing heavy pajamas and a robe. The woman is only going to the end of the driveway to retrieve the newspaper, so she decides not to put on extra clothing. As she exits the house and the door closes, she realizes that the door handle is locked and the keys are inside. | | | | | | | | | | | |
| Segment 2 | The young woman is stuck outside on a cold Anchorage morning. The temperature outside is -10 degC. She is stuck outside for about 45 minutes. | | | | | | | | | | | |
| The woman's housemates realize that she is outside. They bring her in and sit her next to the fire. They also br Segment 3 blankets. Although hypothermia had begun, the woman seems to improve with the active heating and addition housemates decided to continue the day as normal. | | | | | | | | | | | | |
| References Publications: | Herman, Irving P. <i>Physics o</i> | f the Human Rody Pa 345 | | | | | | | | | | |
| 1 | Tierman, II ving 1 . Thysics o | Tille Haman body 1 g. 343 | | | | | | | | | | |
| 2 | Mallet, M. L. "Pathophysiology of Accidental Hypothermia." Qjm 95.12 (2002): 775–785. Print. | | | | | | | | | | | |
| 3 | Reuler, James. "Hypothermia: Pathophysiology, Clinical Settings, and Management." Annals of Internal Medicine 89.4 (1978): 519–527. Print. | | | | | | | | | | | |
| Williams, A B. "Rewarming of Healthy Volunteers after Induced Mild Hypothermia: A Healthy Volunteer Study." Medicine Journal 22.3 (2005): 182–184. CrossRef. Web. | | | | | | | | | | | | |
| SMEs: | Wedlerine Journal 22.5 (200 | 5). 102 10 ii Crossiteii web | • | | | | | | | | | |
| S 1 | Rodney Metoyer - Former | Army Combat Medic | | | | | | | | | | |
| S2 | Bryan Bergeron, M.DPres | sident, Archetype Technolog | ies, Inc. | | | | | | | | | |
| Кеу | | | | | | | | | | | | |
| | Good Agreement with data/trends | | | | | | | | | | | |
| | Agreement with most trend some deviations from validation data/trends | ds, | | | | | | | | | | |
| | Some major disagreements with validation data/trends | | | | | | | | | | | |

| Environment | Exposure | Breakdo |
|-------------|----------|---------|

| Segment Number | Start Time (s) | Segment Duration (s) | Event (to begin segment) | Notes (End Segment Expected Physiology to right) | HeartRate (BPM) | BioGears HeartRate (BPM) | MeanArterialPressure (mmHg) | BioGears MeanArterialPressure (mmHg) | SystolicArterialPressure (mmHg) | BioGears systolicArterialPressure (mmHg) | DiastolicArterialPressure (mmHg) | BioGears DiastolicArterialPressure (mmHg) | RespirationRate (Breaths/min) | BioGears RespirationRate (Breaths/min) | CoreTemperature (C) | BioGears CoreTemperature (C) | SkinTemperature (C) | BioGears SkinTemperature (C) | Oxygen Consumption (mL/min) | Oxygen Consumption (mL/min) | Carbon Dioxide Production (mL/min) | Carbon Dioxide Production (mL/min) | Metabolic Rate (W) | Metabolic Rate (W) |
|-------------------|----------------|-------------------------|---|---|--------------------------------------|--------------------------------|--|--|---|--|---|---|----------------------------------|--|------------------------|------------------------------|------------------------|------------------------------|--|-----------------------------|---|------------------------------------|--|-----------------------|
| 0 | 0 | 60 | Initialization (Advance time 1 minute) | Standard initialization buffer for scenarios. At the end of this segment this patient is in a resting physiological state. For validation references see the biogears documentation on resting physiology validation. | 72 | 73 | 92 | 95 | 100 - 120 | 114 | 79 | 73 | 12 - 20 | 17 | 37 | 37 | < core [S1] | 33 | 250 | 200 | 200 | 170 | 67.64 [Harris-Benedict Equation] | 67.5 |
| 1 | 60 | 2400 | Cold Exposure (Environment change to Alaska outdoors for 10 minutes) | At the end of this segment patient has been exposed to very low temeratures for 10 minutes | Increase initially then decrease [2] | 130 | Small rise then gradual fall below baseline [3] | 102 | Small rise then gradual fall below baseline [3] Increase initially then decrease as core temp drops [S2] | 115 | Trending with systolic pressure [S2] | 85 | Increasing [2] | 30 | < 35 [3] | 36 | < core [S1] | | Decrease in hypothermia [3] Increase as metabloic rate increases and then decrease with metabolic rate when core temp < ~35 [S1] 1130 - 1320 with light activity [1] | 475 | Decrease in hypothermia [3] See Oxygen Consumption [S1] | 400 | approximately 350% increase over BMR (304.38 W for this patient) [4] | |
| 2 | 2460 | 630 (E | Active Heating and Additional Clothing (Environment change to indoors and active heating applied to skin) | At the end of this segment patient has been indoors and actively heated for 10 minutes | Back toward baseline [S1] | 120 | Increasing back to baseline [3] Back to baseline [S1] | 100 | Increasing back to baseline [3] Trending back toward baseline [S2} | 115 | Trending with systolic pressure [S2] | 82 | Decreasing to baseline [32, S1] | 28 | > 35 [3] | 36 | < core [S1] | 30 | Increase [3] Back toward baseline [S1] | 450 | Increase [3] Back toward baseline [S1] | 360 | Back toward baseline [S1] | 370 |
| End | 3090 | | End Scenario | | | | | | | | | | | | | | | | | | | | | |