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 Pulse physiology engine to siimulate physiology when the body is exposed to an abnormal environment.

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

Scenario Narrative

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.
Segment 3	The woman's housemates realize that she is outside. They bring her in and sit her next to the fire. They also bring her coats and blankets. Although hypothermia had begun, the woman seems to improve with the active heating and additional clothing, so the housemates decided to continue the day as normal.

References

Publications:

1	Herman, Irving P. *Physics of the Human Body* Pg. 345
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.
4	Williams, A B. “Rewarming of Healthy Volunteers after Induced Mild Hypothermia: A Healthy Volunteer Study.” Emergency Medicine Journal 22.3 (2005): 182–184. CrossRef. Web.

SMEs:

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Key

	Good Agreement with data/trends
	Agreement with most trends, some deviations from validation data/trends
	Some major disagreements with validation data/trends

Environment Exposure Breakdown

Segment Number	Start Time (s)	Segment Duration (s)	Event (to begin segment)	Notes (End Segment Expected Physiology to right)	HeartRate (BPM)	Engine HeartRate (BPM)	MeanArterialPressure (mmHg)	Engine MeanArterialPressure (mmHg)	SystolicArterialPressure (mmHg)	Engine SystolicArterialPressure (mmHg)	DiastolicArterialPressure (mmHg)	Engine DiastolicArterialPressure (mmHg)	RespirationRate (breaths/min)	Engine RespirationRate (breaths/min)	CoreTemperature (C)	Engine CoreTemperature (C)	SkinTemperature (C)	Engine 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 Engine 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]	170	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]	26	< 35 [3]	36	< core [S1]	24	Decrease in hypothermia [3] Increase as metabolic rate increases and then decrease with metabolic rate when core temp < ~35 [S1] 1130 - 1320 with light activity [3]	475	Decrease in hypothermia [3] See Oxygen Consumption [S1]	400	approximately 250% increase over BMR (304.38 W for this patient) [4]	420
2	2460	630	**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]	170	Increasing back to baseline [3] Back to baseline [S1]	100	Increasing back to baseline [3] Trending back toward baseline [S1]	115	Trending with systolic pressure [S2]	82	Decreasing to baseline [32, S1]	25	> 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																					