



## **“Of Frozen Fingers and Polio Feet” A warming winter tale for everyone who hates the cold.**

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Polio survivors are extremely sensitive to changes in temperature. At merely cool temperatures, polio survivors report that their feet have always been cold to the touch, their skin a purplish color. However, as polio survivors have aged, 50% report intolerance to cold and that their limbs have become more sensitive to pain as the temperature decreases. Cold was reported to cause muscle weakness in 62% of polio survivors, muscle pain in 60%, and fatigue in 39%. (Bruno & Frick, 1987).

When polio survivors were cooled in our laboratory from 86° F to 68° F, motor nerves functioned as if they were at 5° F and polio survivors lost 75% of their hand muscle strength. (Bruno, et al., 1985a) And, although polio survivors were twice as sensitive to pain as those without polio at room temperature, no increase in pain sensitivity was found at lower temperatures. (Bruno, et al., 1985b)

The reason polio survivors have such trouble with cold is that the parts of the central nervous system that should control body temperature were damaged by the poliovirus. In the brain the hypothalamus (the automatic computer that controls the inner bodily environment) was damaged by the poliovirus, including the body's thermostat and the brain area that tells your blood vessels to constrict. (Bodian, 1949) In the spinal cord, the nerves that carry the message from the brain that tells the capillaries in the skin to contract when it's cold were also by the poliovirus. (Bodian, 1949) Thus, polio survivors are unable to stop warm blood from flowing to the surface of the skin as the outside temperature drops. This allows loss of heat from the blood near the surface of the skin and causes the limbs to cool. When the limbs cool, arteries carrying blood to the skin and veins that should carry blood out of the skin narrow passively as they get cold; trapping blue venous blood in the capillaries and causing the feet to look blue and to become even colder. The cold skin chills the motor nerves, causing them to conduct more slowly and to be less efficient in making muscles contract. The cold also chills tendons and ligaments (like putting a rubber band in the freezer) making movement of weak muscles more difficult. As polio survivors know, it takes hours under an electric blanket or a long, hot bath to warm cold legs and regain strength.

However, when polio survivors take a hot bath, blood vessels do exactly the opposite of what they do in the cold. Polio feet and legs become bright red as arteries and veins relax and blood rushes to the skin. Then, when polio survivors stand to get out of the tub, they can feel dizzy or even faint as blood pools in their legs and causes their blood pressure to drop (see Bruno, 1996). The pooling of blood in the feet also explains why polio survivors' feet swell, swelling that increases as they get older. And polio survivors' easily losing body heat explains why they have an increase in symptoms, especially cold-induced muscle pain, as the seasons change.

Polio survivors need to dress as if it were 20° F colder than the outside temperature. The trick is to stay warm from the get-go. You need to dress in layers and wear heat-retaining socks or undergarments made of a woven, thin, breathable plastic fiber called polypropylene (marketed as Gortex or Thinsulate) that should be put on immediately after showering when the skin is warm in the morning. Then put on warm socks, even electric socks with battery-powered heaters. Also, try to keep your feet elevated during the day.

For your hands, Valu-tek ([www.cleanroomconsumables.com](http://www.cleanroomconsumables.com)) makes lightweight gloves that are designed for dexterity indoors. We tested three gloves in polio survivors whose hands are cold inside the home. The nylon "Glove Liner" (VTGNLR-1/1) and the "Conductive Glove" (VTGCONKT), which is made of polyester knit, have full-length fingers. Of the two, the polyester knit is warmer, but somewhat thicker. There is also a nylon glove liner" (VTGNLR-1/2) that has half-fingers that allow more dexterity, but isn't as warm. Polio survivors found that the gloves keep hands warm and allowed them to use their fingers, to read, to eat and even to knit, but they liked the nylon "Glove Liner" with full fingers best. The gloves come by the dozen, so you can launder them and have some to wear. The gloves liners and conductive gloves are rather expensive, but worth it. Since these are disability-related products, they should be tax deductible.

If you still can't stay warm, you can talk to your doctor about taking the anti-hypertension drug Minipress that open your arteries and get more hot blood to your feet. However, these drugs can open arteries too much and cause you to lose heat from your uncovered skin and drop your blood pressure when you stand. These are drugs of last resort to be used very carefully!

Polio survivors need to remind doctors that EMGs or nerve conduction tests must be performed in a room that is at least 75° F to prevent false abnormal readings and that a heated blanket is necessary in the recovery room after polio survivors have surgery (Bruno, 1996).