Purpose:
Urethral warming system (Gaymar Industries, Orchard Park, NY) uses a peristaltic pump to circulate warming fluid through an urethral catheter and is essential in preventing injury to bladder neck and urethral tissues during interstitial cryoablations of prostate cancer. We present results of the urethral warmer's effect on isotherms during cryotherapy in a phantom model.

Methods:
Freeze-thaw cycles using Presice Cryoablation SystemTM with 17-gauge, 1.47mm IceRodTM cryoneedle (Galil Medical, Yoknean, Israel) were performed in a cylindrical gel phantom designed to simulate patient anatomy. The cryoneedle was inserted 5mm from the walls of the urethral catheter, which was positioned along the axis of the phantom. Temperatures were simultaneously measured at 17 locations using an arrangement of multipoint and single point thermal sensors. Three 10-minute freeze cycles followed by 10-minute thawing were performed for the following pump speed settings: 9 (10.3ml/sec), 3 (3.7ml/sec), and 0 (inactive warmer).

Results:
No statistically significant differences between temperatures corresponding to pump speed settings 9 and 3 were observed ($p=0.1$). For active warmer, average temperatures measured at the location of cryoneedle and along the warmer surface were -33±4 and -10±1ºC, correspondingly. The temperatures corresponding to freeze cycle with the warmer inactive were -41±6 and 20±6ºC ($p=0.004$).

Conclusions:
Active urethral warmer had a significant effect on the temperatures measured along the surface of the warmer and at the location of the cryoneedle. With the active warmer, temperatures at the warmer surface were elevated to levels inadequate for tissue ablation. At the same time, temperatures at the cryoneedle were also elevated beyond manufacturers specifications, which could affect efficiency of targeted tissues ablation and should be accounted for during treatment. These results support use of the urethral warming system as a protective measure during interstitial cryotherapies of prostate cancer and generate critical treatment planning information.