Neuromuscular function declines with advancing age and is strongly associated with increased risk for falls, hip fractures and decreased quality of life. A variety of tools, e.g., chairrise or timed-up-and-go, assess muscle function. However, a need exists for more sensitive tools to evaluate interventions designed to enhance neuromuscular performance. Jumping mechanography quantitatively measures an individual’s ability to generate power and correlates with the methods noted above. However, only limited data exist on the safety of older adults performing maximal countermovement jumps (CMJ) on a force platform. As such, this study investigated safety and utility of jumping mechanography in 40 (21 men; 20 women) community-dwelling adults over age 60. At baseline, jumping mechanography of two-leg CJ was performed on a force platform (Lantost, Norvic, Pfalzgrafen, Germany). All participants completed three maximal CJ: maximal jump height [cm] and specific power [W/kg] were calculated. Maximal outcomes were screening pain and new vertebral fracture. Pain was assessed using a visual analog scale before and immediately after performing CJ and 7 days later. Three bone mineral density (BMD) and vertebral fracture assessment (VFA) were performed using a Lunar iDXA densitometer (GE Healthcare, Madison, WI) prior to CJ and VFA was repeated in 7 days. Statistician measured height was obtained at baseline and day 7. Data were analyzed using linear regression and t-test. Age [mean (±SD), range]: 76 (±5, 65-91) years and 25.5 (±3), 19.4-43.1 kg/m² respectively. Mean lowest T-score of the L-1 spine, total femur or femur neck was -0.3 (±2.6 range: -10.3 to 3.1). At baseline, 7 participants had prevalent fractures; 4 had multiple fractures. Pain and jump height were lower in our older volunteers and did not differ by gender. Mean jump height in women was 14.4 cm and 16.4 cm in men. Mean pain was women in 18.2 W/kg and 5.8 ± 21.1 W/kg in men. Pain was low at baseline and follow-up, ranging from 0 to 5. Pain was reported by 8 individuals before jumping; after jumping, 4 reported a pain change of 1, 1 scored new pain, new and one improved. A week later, compared to baseline, 6 reported worsening pain and 4 improved. No height or vertebral fracture status change was observed after jumping. In summary, jumping mechanography demonstrates lower jump height and generated power with advancing age. Additionally, it is safe to use with substantial increase in pain or worsening of vertebral fracture status in older adults, including those with low BMD and prevalent vertebral fracture. Further evaluation of this methodology as a tool to detect change in neuromuscular performance of older adults is indicated.

METHODS
Participants
• 40 (21 men; 20 women), community-dwelling adults over age 60
• Height was measured using a wall-mounted stadiometer

Jumping Mechanography (Figure 1)
Two-leg countermovement jumps (CJ) were performed on a force platform (Lantost, Norvic, Pfalzgrafen, Germany). All participants completed three maximal CJ: maximal jump height [cm] and specific power [W/kg] were calculated. Maximal outcomes were screening pain and new vertebral fracture. Pain was assessed using a visual analog scale before and immediately after performing CJ and 7 days later. Three bone mineral density (BMD) and vertebral fracture assessment (VFA) were performed using a Lunar iDXA densitometer (GE Healthcare, Madison, WI) prior to CJ and VFA was repeated in 7 days. Statistician measured height was obtained at baseline and day 7. Data were analyzed using linear regression and t-test. Age [mean (±SD), range]: 76 (±5, 65-91) years and 25.5 (±3), 19.4-43.1 kg/m² respectively. Mean lowest T-score of the L-1 spine, total femur or femur neck was -0.3 (±2.6 range: -10.3 to 3.1). At baseline, 7 participants had prevalent fractures; 4 had multiple fractures. Pain and jump height were lower in our older volunteers and did not differ by gender. Mean jump height in women was 14.4 cm and 16.4 cm in men. Mean pain was women in 18.2 W/kg and 5.8 ± 21.1 W/kg in men. Pain was low at baseline and follow-up, ranging from 0 to 5. Pain was reported by 8 individuals before jumping; after jumping, 4 reported a pain change of 1, 1 scored new pain, new and one improved. A week later, compared to baseline, 6 reported worsening pain and 4 improved. No height or vertebral fracture status change was observed after jumping. In summary, jumping mechanography demonstrates lower jump height and generated power with advancing age. Additionally, it is safe to use with substantial increase in pain or worsening of vertebral fracture status in older adults, including those with low BMD and prevalent vertebral fracture. Further evaluation of this methodology as a tool to detect change in neuromuscular performance of older adults is indicated.

Jumping Mechanography
• Max jump height and jump power:
  - Women: 14.4 cm ± 5.8 and 19.2 W/kg ± 5.6
  - Men: 16.4 cm ± 6.3 and 21.2 W/kg ± 6.3

Power and jump height were lower at older ages (Figure 4)
No statistically significant differences were found between genders (Figure 3a ± 3). Bone Assessment
• Mean BMD T-score of the L-1 spine, total femur or femur neck was -1.43 ± 3.1; range: -2.43 to -1.3.
• A total of 10 participants were osteopenic; an additional three met osteoporosis criteria by DXA T-score of -2.5
No change in height or vertebral fracture status by VFA was observed after jumping.

Pain
• Pain was low at baseline and follow-up, ranging from 0 to 5, with a mean value of 0.4
• Pain was experienced by eight individuals before jumping.
  - Immediately after jumping four reported a pain change of one, two noted new pain, one scored and one improved.
  - Pain scores returned to baseline; six reported new pain and six reported low.

CONCLUSIONS
• Countermovement jumps are used to measure jump height and jump power on a force platform.
• Jumping mechanography correlates with other tests commonly used to assess neuromuscular function.
• Jumping mechanography has potential advantages to deliver quantitative results in broad patient populations.
• Participants in this study included older males and females with and without osteoporosis.
• These results indicate that jumping mechanography is safe in this population and does not cause new vertebral fractures or additional pain.

No significant gender difference was found in jumping performance, this might be due to small study size and selection bias.

Participants
• Age [mean (±SD), range]: 77 (±3, 63-91) years and 25.5 (±3), 19.4-43.1 kg/m²
• BMI [mean (±SD), range]: 25.3 (±4.1), 19.0-34.1 kg/m²

Jumping Mechanography
• Max jump height and jump power:
  - Women: 14.4 cm ± 5.8 and 19.2 W/kg ± 5.6
  - Men: 16.4 cm ± 6.3 and 21.2 W/kg ± 6.3

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No change in height or vertebral fracture status by VFA was observed after jumping.

Pain
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• Pain was experienced by eight individuals before jumping.
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