### Disclosure presenter

<table>
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<tr>
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<th>No (potential) conflict of interests</th>
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<td>X</td>
<td>1. Relations that could be relevant for the meeting</td>
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<td>X</td>
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Association of physical activity and sitting time with physical function in hemodialysis patients

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Background

- Impaired physical function increases the risk of hospitalization, dependency and mortality for hemodialysis (HD) patients (Cook & Jassal, 2008; Knight et al., 2003).
- Exercise appears to be an effective intervention to improve function (Bennett et al., 2016).
- Previous studies mainly focus on determining the relationship between physical inactivity and physical function and the effectiveness of structured exercise programs (Souweine et al., 2018).
- Differentiation of physical activity classes is more informative than overall physical activity.
Background

- Physical inactivity and increased time at bed rest are commonly observed in HD patients (Avesani et al., 2012).
- Prolonged sitting time, as distinct from too little physical activity, has been detrimentally associated with health outcomes in general population (Chau et al., 2013).
- However, relatively few studies explored the relationship between sitting time and functional outcomes in dialysis patients.
Aim

- The purpose of this study was to evaluate the relationship among physical activity levels (sitting, light, moderate, vigorous), sitting time and physical function in HD patients.
Subjects and Methods

- Study design
  - This was a cross-sectional study
    * Analyzed the association between physical activity, sitting time, and physical performance measures.

- Study setting
  - A hemodialysis center of a tertiary hospital in China.
Participants

- Patients with Stage 5 CKD on HD treatment were enrolled

  - **Inclusion criteria**: age $\geq 18$ years older; receiving thrice-weekly HD for at least 3 months; able to communicate in Chinese.

  - **Exclusion criteria**: hospitalized in the 4 weeks prior to the study commencement; had any musculoskeletal condition that prevented functional testing; unable to give informed consent.
Physical activity level

- International Physical Activity Questionnaire (IPAQ) Short Form
  - Questions assess the frequency and duration of vigorous and moderate physical activity, as well as walking and sitting, over the prior 7 days.
  - Records the activity of 4 intensity levels
    - Vigorous-intensity activity
    - Moderate-intensity activity
    - Walking or light activity
    - sitting

See [www.ipaq.ki.se](http://www.ipaq.ki.se) for data processing guidelines.
Physical function

- 10-repetition sit to stand (10-STS)
  - Is an assessment of lower body muscle strength, dynamic balance, and exercise capacity (Wilkinson et al., 2018).
  - Participants were asked to sit in a chair of standard height, and asked to stand up completely and sit back down 10 times with arms across over the chest.
  - Reliability has been demonstrated in patients undergoing HD (Segura-Orti & Martinez-Olmos, 2011).
Anthropometric measures

- Triceps skin-fold thickness (TSF) was measured with a calliper on the non-access side of the patients.
- Mid-arm circumference (MAC) was measured by a tape at the midpoint between the acromion and the olecranon.
- Mid-arm muscle circumference (MAMC) (cm) = MAC (cm) – 3.14 × TSF(cm).
Anthropometric measures

- Handgrip strength (HGS)
  - measured with a hand-held dynamometer by a experienced clinical staff.
  - Patients were instructed to complete the measures on the contralateral arm of the fistula arm in a standing position.
Demographic and laboratory data

- Age, gender, race and comorbid conditions were obtained by participant interview and review of medical records.
- The most recent laboratory reports of albumin, pre-albumin, hemoglobin, high-sensitivity C-reactive protein (hs-CRP) were obtained from the medical record.
Statistical analysis

- The results are expressed as mean ± SD.
- Normality of data distribution were checked by the Kolomogorow-Smirnoff test.
- Non-normality distributed data were reported as median (Interquartile range [IQR]) and logarithmically transformed before further analysis.
Statistical analysis

- Bivariate and multivariable linear regression analyses were used to determine the associations among physical activity levels, sitting time, and 10-STS.
- Covariates included in the multivariable linear regression analyses were age, gender.
## Results

**Table 1: Demographic, clinical, and biochemical characteristics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants (n = 130)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>61.02 (12.26)</td>
</tr>
<tr>
<td>Sex (n, % male)</td>
<td>84 (64.60)</td>
</tr>
<tr>
<td><strong>Education levels</strong></td>
<td></td>
</tr>
<tr>
<td>Primary or below</td>
<td>24 (18.50)</td>
</tr>
<tr>
<td>Secondary</td>
<td>78 (60.00)</td>
</tr>
<tr>
<td>Tertiary or above</td>
<td>28 (21.50)</td>
</tr>
<tr>
<td>Years on dialysis, median (IQR)</td>
<td>6.00 (2.00, 11.25)</td>
</tr>
<tr>
<td><strong>Cause of end-stage renal disease</strong></td>
<td></td>
</tr>
<tr>
<td>Chronic glomerular nephritis</td>
<td>42 (32.30)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>13 (10.00)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>10 (7.70)</td>
</tr>
<tr>
<td>Others</td>
<td>11 (8.50)</td>
</tr>
<tr>
<td>Unknown</td>
<td>54 (41.5)</td>
</tr>
</tbody>
</table>
### Results _ Table 1_ Demographic, clinical, and biochemical characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants (n = 130)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus (n, % Yes)</td>
<td>27 (20.80)</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>109.54 (16.26)</td>
</tr>
<tr>
<td>Albumin (mg/dL)</td>
<td>40.05 (3.04)</td>
</tr>
<tr>
<td>Pre-albumin (mg/L)</td>
<td>340.19 (90.80)</td>
</tr>
<tr>
<td>Other variables</td>
<td></td>
</tr>
<tr>
<td>Handgrip strength (Kg)</td>
<td>25.63 (9.36)</td>
</tr>
<tr>
<td>Mid-arm muscle circumference (cm)</td>
<td>23.79 (2.45)</td>
</tr>
<tr>
<td>Triceps skin-fold thickness (cm)</td>
<td>1.37 (0.44)</td>
</tr>
<tr>
<td>10-STS (seconds)</td>
<td>29.55 (16.39)</td>
</tr>
</tbody>
</table>
## Results — Table 2 Physical activity pattern

<table>
<thead>
<tr>
<th>Physical activity component</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total physical activity (MET-min/week)</td>
<td>1493.66 (1595.24)</td>
</tr>
<tr>
<td>Physical activity (min/week)</td>
<td>479.92 (547.95)</td>
</tr>
<tr>
<td>Physical activity level (n, %)</td>
<td></td>
</tr>
<tr>
<td>Inactive</td>
<td>33 (25.40)</td>
</tr>
<tr>
<td>Minimally active</td>
<td>85 (65.40)</td>
</tr>
<tr>
<td>HEPA active</td>
<td>12 (9.20)</td>
</tr>
<tr>
<td>Daily sitting time (Minutes/day) [Media, IQR]</td>
<td>480 [284, 780]</td>
</tr>
</tbody>
</table>

NOTE. Abbreviations: SD, standard deviation; MET, metabolic equivalent of energy; IQR, inter-quartile range.
Results — Table 3 Univariable linear regression models of the risk factors for low 10-STS performance

<table>
<thead>
<tr>
<th>Factor</th>
<th>β (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.436 (0.43 to 0.44)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Female sex</td>
<td>-0.191 (-0.36 to -0.03)</td>
<td>0.029</td>
</tr>
<tr>
<td>HGS</td>
<td>-0.338 (-0.35 to -0.33)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Time spent on light physical activity</td>
<td>-0.335 (-0.34 to -0.33)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Daily sitting time (&gt; 480 min)</td>
<td>0.131 (-0.03 to 0.29)</td>
<td>0.136</td>
</tr>
<tr>
<td>Albumin</td>
<td>-0.331 (-0.36 to -0.31)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pre-albumin</td>
<td>-0.382 (-0.39 to -0.38)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>hs-CRP</td>
<td>0.315 (0.25 to 0.38)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

NOTE. All results significant at P<0.20.
Abbreviations: β, beta coefficient; HGS, handgrip strength; hs-CRP, high-sensitivity C-reactive protein.
### Results

**Table 4** Multivariable linear regression model of the risk factors for low 10-STS performance

<table>
<thead>
<tr>
<th>Factor</th>
<th>β (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent on light physical activity</td>
<td>-0.239 (-0.25 to -0.23)</td>
<td>0.001</td>
</tr>
<tr>
<td>HGS</td>
<td>-0.302 (-0.31 to -0.29)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pre-albumin</td>
<td>-0.182 (-0.19 to -0.18)</td>
<td>0.021</td>
</tr>
</tbody>
</table>

**Note.** All results significant at P<0.05. $R^2 = 0.470.$

Abbreviations: β, beta coefficient; HGS, handgrip strength.
Discussion

- The gold standard measure for assessment of physical function is the peak oxygen uptake in a graded exercise test. Less used in clinical setting:
  - Needs for special and high-cost equipment
  - Limited physical function in HD patients (Johansen et al., 2017)
- The mean time for competing 10-STS test was 29.6 seconds
  - Being similar to that measured in the Frih et al. (2017)’s study for HD patients of similar age categories.
Discussion

- The total physical activity for the IPAQ was approximately 480 minutes per week, 1494 MET-minutes/week, and the average time spent sitting was 532 minutes/day.
  - Compared to healthy subjects in Bueno et al. (2017)’s study, HD patients had a low level of physical activity, and metabolic equivalent, and more time sitting.
Discussion

- Light-intensity physical activity (walking) was associated with physical function in HD patients.
  - Regular walking seems to improve exercise capacity in adults with congenital heart disease, and activity sustainably (Dua et al., 2010).
  - Low-intensity exercise training and home-based walking could improve functional capacity but not exercise capacity in HD patients (Bohm et al., 2014; Esteve et al., 2014).
Discussion

- Exercise is beneficial, but is not often translated into meaningful exercise prescription practice (Koufaki et al., 2015).
- Barriers to the provision of exercise service
  - Funding, lack of time, and lack of appropriate exercise personnel (Greenwood, 2017; Jhamb et al., 2016).
- Patient-perceived barriers: Lack of motivation, being incapable of exercise (Hannan & Bronas, 2017).
- Regular walking is save, and a potential harm of exercise could be ruled out (Dua et al., 2010).
Discussion

- Physical activity may be likely *conditional* on maintaining sort of physical function (Metti et al., 2018).
  - Other importance factors, such as muscle loss, weigh gain add a complexity in understanding the complex relationships between physical activity and physical function.
Discussion

- In this study, HGS and pre-albumin were shown to be related with physical performance.
  - HGS, being not influenced by the inflammatory status, is a mark of muscle function related to nutritional status in patients on dialysis (Garagarza, Flores, & Valente, 2018; Leal et al., 2011).

- The decline in strength is often more rapid than the concomitant loss of muscle mass (McGregor, Cameron-Smith, & Poppitt, 2014; Wilkinson et al., 2018).

- Muscle strength is perhaps one important factor among the various determinants of physical function in HD patients.
Discussion

- Sitting time was NOT associated with physical performance in HD patients.
  - Patients spent on average, over 8 hour sitting each day in the current study.
  - A previous study revealed that sitting time was associated with muscle mass, HGS and pre-sarcopenia in community-dwelling older adults (Reid et al., 2018).

- Sitting time may affect physical function through body composition changes progress slowly without overt clinical symptoms until years.
Limitations

- The cross-sectional nature of the study
  - Unable to assess changes in physical function and physical activity.
  - Unable to infer any causal relationships between light intense physical activity and physical function.
- Physical activity was evaluated by self-reporting questionnaire.
  - Respondents may have under-or over-reported data, affecting the associations among variables.
Conclusion and implications

- This study observed that light physical activity, HGS, and pre-albumin were associated with physical function.
- Sitting time was not associated with sit-to-stand performance in this sample of HD patients.
- Future studies are needed to evaluate
  - the impact of body composition on the pathophysiology of sitting-function association.
  - longitudinal changes in muscle strength, physical activity and function.
References


References


Thank you

Q & A