**SUPPLEMENTAL MATERIALS FOR:**

**Kidney Disease Symptoms Before and After Kidney Transplantation**

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**Supplemental Figure 1: Derivation of the Kidney Transplant Candidate and Recipient Cohorts.**

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The figure displays the number of patients in each cohort that are used to estimate 1) the risk of waitlist mortality, 2) the pre- and post-transplantation changes in symptoms, and 3) post-transplantation trajectories of symptoms.

JH: Johns Hopkins Hospital; UM: University of Michigan University Hospital.

**Supplemental Table 1: Distributions of Symptoms of Kidney Disease Scores from the KDQOL-SF among kidney transplant candidates (at evaluation) and recipients (at admission) as compared to the reference population.**

|  |  |  |
| --- | --- | --- |
|  | **Reference population** | **Study populations** |
| US dialysis patients(n= 70,786) | Candidates(n=1,298) | Recipients(n=521) |
| Minimum | 0 | 8.3 | 8.3 |
| 25th percentile | 71 | 75.0 | 75.0 |
| 50th percentile | 81 | 85.4 | 83.3 |
| 75th percentile | 91 | 93.2 | 91.7 |
| Maximum | 100 | 100.0 | 100.0 |

The reference population was published by *Peipert* *et al*. (34)

**Supplemental Table 2: Prevalence of Very High Symptom Burden by Risk Factors and Functional and Cognitive Status Among Kidney Transplant Candidates (n=1,298).**

|  |  |  |
| --- | --- | --- |
|  | **Model 1** | **Model 2** |
| PR (95% CI) | PR (95% CI) |
| **Risk factors** |  |  |
|  Older age (≥65 years) | **0.55 (0.40, 0.75)** | **0.52 (0.37, 0.73)** |
|  Female sex | **1.46 (1.19, 1.80)** | **1.38 (1.11, 1.73)** |
|  Black race | 0.93 (0.75, 1.15) | 0.91 (0.72, 1.13) |
|  Hemodialysis\* | **1.34 (1.04, 1.72)** | 1.26 (0.96, 1.65) |
|  Peritoneal dialysis\* | 1.08 (0.76, 1.54) | 1.03 (0.72, 1.49) |
|  Time on dialysis, per 3 months | 1.00 (0.99, 1.01) | 1.00 (0.99, 1.01) |
|  BMI, per 5kg/m2 | **1.10 (1.01, 1.20)** | **1.10 (1.01, 1.20)** |
| **Functional and cognitive status** |  |  |
|  Frailty | **1.76 (1.37, 2.26)** | **1.47 (1.11, 1.93)** |
|  Cognitive impairment | 0.83 (0.47, 1.46) | 0.86 (0.49, 1.52) |
|  Lower extremity impairment | **1.29 (1.03, 1.61)** | 1.12 (0.88, 1.42) |
|  Activities of daily living functional impairment | **1.89 (1.36, 2.61)** | 1.34 (0.91, 1.98) |
|  Instrumental activities of daily living functional impairment | **1.76 (1.41, 2.19)** | **1.48 (1.14, 1.93)** |

\* Pre-emptive transplant /No dialysis as the reference group.

Model 1: adjusted for risk factors (age group, sex, Black race, dialysis type, time on dialysis, and BMI).

Model 2: adjusted for risk factors and functional and cognitive status (frailty, cognitive impairment, lower extremity impairment, activities of daily living functional impairment, and instrumental activities of daily living functional impairment).

Candidates were enrolled at evaluation for kidney transplant. The overall symptom score ranged from 0-100 points and was based on self-reported burden of individual symptom/problem of kidney disease with 5 response options ranging from “not at all bothered” to “extremely bothered.” The individual symptom scores were transformed to a scale of 0-100 possible range, where a higher score represents lower burden. The overall symptom score was calculated by averaging across the 12 individual scores, so a higher symptom score represents a lower burden. Symptom burden was defined as: very high 0.0-71.0, high 71.1-81.0, medium 81.1-91.0, and low 91.1-100.0. Prevalence Ratios (PRs) and 95% Confidence Intervals (CIs) are presented from adjusted modified Poisson models. Associations that are statistically significant at p<0.05 are bolded.

BMI: body mass index.

**Supplemental Table 3: Changes in Kidney Disease Symptom Burden Between Evaluation and Admission for Kidney Transplantation Using the Combined Candidate and Recipient Cohorts (n=190).**

|  |  |
| --- | --- |
| **n (%)** | **Symptom Burden at Transplantation** |
| Low | Medium | High | Very high |
| **Symptom Burden at Evaluation** |
| Low | 28 (15%) | 17 (9%) | 10 (5%) | 1 (0.5%) |
| Medium | 16 (8%) | 25 (13%) | 16 (8%) | 12 (6%) |
| High | 3 (2%) | 10 (5%) | 6 (3%) | 8 (4%) |
| Very high | 3 (2%) | 8 (4%) | 7 (4%) | 20 (11%) |

Candidates were enrolled at evaluation; recipients were enrolled at admission for transplantation.The overall symptoms score ranged from 0-100 points and was based on self-reported burden of individual symptom/problem of kidney disease with 5 response options ranging from “not at all bothered” to “extremely bothered.” These are overall %; the shaded cells represent no change. Symptom burden was defined as: very high 0.0-71.0, high 71.1-81.0, medium 81.1-91.0, and low 91.1-100.0.

**Supplemental Table 4: Risk of Waitlist Mortality by Individual and Overall Symptom Scores Among Kidney Transplant Candidates Undergoing Pre-Transplantation Dialysis.**

|  |  |  |
| --- | --- | --- |
|  | **cSHR (95% CI)****n=762** | **aSHR (95% CI)****n=747** |
| **Individual symptom scores (range 0-100, per 10 points worse)** |
|  Muscles soreness | **1.06 (1.002, 1.13)** | **1.08 (1.02, 1.15)** |
|  Chest pain | **1.14 (1.04, 1.25)** | **1.16 (1.04, 1.28)** |
|  Cramps | 1.03 (0.97, 1.09) | 1.04 (0.97, 1.10) |
|  Pruritus | 0.99 (0.93, 1.05) | 1.00 (0.94, 1.07) |
|  Xeroderma | 0.98 (0.93, 1.04) | 1.01 (0.95, 1.07) |
|  Dyspnea | 1.06 (0.98, 1.14) | **1.09 (1.004, 1.18)** |
|  Dizziness | 1.00 (0.91, 1.11) | 1.02 (0.92, 1.13) |
|  Anorexia | 1.03 (0.96, 1.11) | 1.07 (0.99, 1.15) |
|  Fatigue | 1.03 (0.97, 1.10) | 1.06 (1.00, 1.13) |
|  Numbness | 1.05 (0.99, 1.12) | 1.05 (0.99, 1.12) |
|  Upset stomach  | 0.98 (0.91, 1.06) | 1.01 (0.94, 1.09) |
|  Site-related (dialysis patients only) | 0.99 (0.91, 1.08) | 1.00 (0.91, 1.10) |
| **Overall symptom score (range 0-100)** |
| **Continuous overall score (per 10 points worse)** | 1.08 (0.96, 1.22) | **1.14 (1.01, 1.29)** |
| **Symptom burden** |  |  |
|  Low | Reference | Reference |
|  Medium | 1.44 (0.84, 2.48) | 1.51 (0.87, 2.60) |
|  High | **1.91 (1.06, 3.45)** | **2.08 (1.16, 3.75)** |
|  Very high | 1.33 (0.75, 2.37) | 1.66 (0.91, 3.01) |

Candidates were enrolled at evaluation for transplant.The overall symptom score ranged from 0-100 points and was based on self-reported burden of individual symptom/problem of kidney disease with 5 response options ranging from “not at all bothered” to “extremely bothered.” The individual symptom scores were transformed to a scale of 0-100 possible range, where a higher score represents lower burden. The overall symptom score was calculated by averaging across the 12 individual scores, so a higher symptom score represents a lower burden. Symptom burden was defined as: very high 0.0-71.0, high 71.1-81.0, medium 81.1-91.0, and low 91.1-100.0. Crude subdistribution hazard ratios (cSHRs) and adjusted subdistribution hazard ratios (aSHRs) with 95% confidence intervals (CIs) are presented from competing-risks models (competing risk of transplantation). Associations that are statistically significant at p<0.05 are bolded. Adjusted models were adjusted for age at evaluation, sex, Black race, dialysis type, time on dialysis, BMI, and cause of kidney failure.

CI: confidence interval; SHR: subdistribution hazard ratio; BMI: body mass index.

**Supplemental Table 5: Risk of Waitlist Mortality and Symptoms of Kidney Disease Among Kidney Transplant Candidates (n=1,282).**

|  |  |
| --- | --- |
|  | **aSHR (95% CI)** |
| **Individual symptom scores (range 0-100, per 10 points worse)** |
|  Muscles soreness | **1.06 (1.01, 1.11)** |
|  Chest pain | **1.16 (1.06, 1.28)** |
|  Cramps | **1.05 (1.00, 1.11)** |
|  Pruritus | 0.99 (0.94, 1.05) |
|  Xeroderma | 0.99 (0.93, 1.04) |
|  Dyspnea | 1.06 (0.998, 1.13) |
|  Dizziness | 0.99 (0.91, 1.08) |
|  Anorexia | **1.07 (1.01, 1.13)** |
|  Fatigue | **1.06 (1.001, 1.11)** |
|  Numbness | 1.03 (0.98, 1.09) |
|  Upset stomach  | 1.04 (0.98, 1.11) |
|  Site-related (dialysis patients only) | 0.99 (0.90, 1.09) |
| **Overall symptom score (range 0-100)** |  |
| **Continuous overall score (per 10 points worse)** | **1.12 (1.01, 1.24)** |
| **Symptom burden** |  |
|  Low | Reference |
|  Medium | 1.22 (0.80, 1.87) |
|  High | 1.30 (0.81, 2.09) |
|  Very high | 1.50 (0.94, 2.40) |

Candidates were enrolled at evaluation.The overall and individual symptoms score ranged from 0-100 points and was based on self-reported burden of individual symptom/problem of kidney disease with 5 response options ranging from “not at all bothered” to “extremely bothered.” The individual symptom scores were transformed to a scale of 0-100 possible range, where a higher score represents lower burden. The overall symptom score was calculated by averaging across the 12 individual scores, so a higher symptom score represents a lower burden. Symptom burden was defined as: very high 0.0-71.0, high 71.1-81.0, medium 81.1-91.0, and low 91.1-100.0. Crude subdistribution hazard ratios (cSHRs) and adjusted subdistribution hazard ratios (aSHRs) with 95% confidence intervals (CIs) are presented from competing-risks models (competing risk of transplantation). Associations that are statistically significant at p<0.05 are bolded. Adjusted models were adjusted for age at evaluation, sex, Black race, dialysis type, time on dialysis, BMI, cause of kidney failure, Charlson Comorbidity Index, smoking status, diabetes, and household income.

CI: confidence interval; SHR: subdistribution hazard ratio; BMI: body mass index.

**Supplemental Table 6: Estimated Overall Symptom Score at Admission for Kidney Transplantation and Post-Transplantation Trajectories Among Recipients Using Tobit Model (n=521).**

|  |  |  |
| --- | --- | --- |
|  | **Estimated score, points (95% CI)** | **Estimated monthly change in score, points per month (95% CI)** |
| **Overall symptom score (range 0-100)** |
| At transplantation  | 82.1 (80.2, 84.0) | - |
| 0-3 months post-transplantation | 90.4 (88.4, 92.3) | **2.77 (2.39, 3.15)** |
| 3-12 months post-transplantation  | 89.7 (87.2, 92.1) | -0.08 (-0.31, 0.15) |

Recipients were enrolled at admission for transplantation.The overall symptom score ranged from 0-100 points and was based on self-reported burden of individual symptom/problem of kidney disease with 5 response options ranging from “not at all bothered” to “extremely bothered.” The individual symptom scores were transformed to a scale of 0-100 possible range, where a higher score represents lower burden. The overall symptom score was calculated by averaging across the 12 individual scores, so a higher symptom score represents a lower burden. Estimated scores and monthly change (slope per unit time of 1 month) with 95% confidence intervals (95% CIs) are presented from an adjusted Tobit model. The scores were estimated for the “reference population” in which age is set to 65, sex to male, race to non-Black, diabetes status to nondiabetic, and time on dialysis to 0 and are estimated for the last day for the time interval. Monthly changes and differences that are statistically significant at p<0.05 are bolded. All models were adjusted for age, sex, Black race, diabetes status, and time on dialysis.