Preliminary analysis of our derivation and validation data suggests that the NIRUDAK model lowers median cost per patient by 90% as compared to the actual cost and by 19% as compared to the cost projected by the WHO model. This trend also holds true when looking at costs associated with initial recommended resuscitation (IRR) and fluid only. The NIRUDAK model lowers median IRR cost per patient by 11% as compared to actual cost and by 6% as compared to the WHO model’s projected cost. Its median projected per patient cost of fluid and associated equipment (e.g. IV tubing and needles) are 41% lower than the actual value and 28% lower than the WHO model value.

Moreover, this preliminary analysis is not able to capture the gains produced by more efficient distribution of human capital and labor. The NIRUDAK model as previously been shown to outperform WHO guidelines, particularly for older patients, and in providing much better sensitivity for severe dehydration, the NIRUDAK model reduces the likelihood of under-triage and under-treatment of these high-risk patients (3). The NIRUDAK model classifies more patients as having severe dehydration (908 patients) as compared to actual diagnostic classification (278 patients) and WHO guidelines (744 patients). It classifies more patients as having some dehydration (624 patients) than actual diagnoses (1437 patients) and the WHO model (937 patients); it also classifies more patients as having no dehydration (607 patients) than actual diagnoses (431 patients) and the WHO model (491 patients). More accurately shifting patients to outpatient or expectant management by classifying them as having some or no dehydration frees up hospital beds and human resources for the care of critically ill patients. However, classifying more patients as having severe dehydration, as the NIRUDAK model does, increases monetary costs as these patients are the most expensive to treat.

Figure 1. Graphical summary of cost comparisons

Table 3. Fluid only cost comparison

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Actual Median** | **WHO Median** | **NIRUDAK Median** | **Actual IQR** | **WHO IQR** | **NIRUDAK IQR** | **Actual Total** | **WHO Total** | **NIRUDAK Total** | **Actual Obs.** | **WHO Obs.** | **NIRUDAK Obs.** |
| **All Patients** | 5.53 (458) | 4.55 (375) | 3.27 (3217) | 2.69 (324) | 3.83 (316) | 4.27 (354) | 12835 (1064432) | 8574 (708647) | 5850 (483949) | 2173 | 2172 | 2139 |
| **No** | 3.31 (277) | 0 (0) | 0 (0) | 3.92 (324) | 0 (0) | 0 (0) | 1719 (142815) | 0 (0) | 0 (0) | 431 | 491 | 607 |
| **Some** | 5.58 (463) | 4.45 (367) | 3.34 (276) | 2.63 (218) | 1.32 (108) | 1.01 (83) | 8923 (739797) | 4125 (340489) | 2072 (171002) | 1437 | 937 | 624 |
| **Severe** | 6.81 (564) | 6.04 (500) | 4.30 (356) | 3.79 (313) | 1.65 (136) | 1.38 (114) | 2126 (17630) | 4449 (368158) | 3778 (312946) | 278 | 744 | 908 |

Under the NIRUDAK and WHO models, patients hypothetically classified as “Severe” would only receive IVF, patients hypothetically classified as “Some” would only receive ORS, and patients hypothetically classified as “No” received no fluid. In the actual study, patients across diagnosis categories received both fluids, e.g. 1382 patients were classified as having “Some” dehydration in the actual study and received both ORS and IVF. These values include do not hospital costs or fixed costs of equipment. Observations missing diagnostic labels for a particular model were omitted in estimating costs for that model.

Table 1. Comparison of actual costs with estimations of NIRUDAK & WHO costs

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Actual Median** | **WHO Median** | **NIRUDAK Median** | **Actual IQR** | **WHO IQR** | **NIRUDAK IQR** | **Actual Total** | **WHO Total** | **NIRUDAK Total** | **Actual Obs.** | **WHO Obs.** | **NIRUDAK Obs.** |
| **All Patients** | 37.73 (3217) | 4.75 (392) | 3.83 (316) | 29.36 (2512) | 14.73 (1253) | 23.53 (2008) | 68739 (5859287) | 27462 (2328614) | 29043 (2473248) | 2173 | 2172 | 2139 |
| **No** | 37.43 (3201) | 0 (0) | 0 (0) | 32.73 (2790) | 0 (0) | 0 (0) | 13161 (1124203) | 0 (0) | 0 (0) | 431 | 491 | 607 |
| **Some** | 37.73 (3217) | 4.45 (367) | 3.34 (276) | 28.77 (5008) | 1.31 (108) | 1.01 (83) | 45746 (3898177) | 4125 (340489) | 2072 (171002) | 1437 | 937 | 624 |
| **Severe** | 39.14 (3331) | 31.37 (2672) | 36.09 (3080) | 26.49 (2249) | 28.33 (2429) | 28.51 (2450) | 9298 (791346) | 23337 (1988125) | 26971 (2302246) | 278 | 744 | 908 |

Values for the NIRUDAK and WHO models were calculated by adding the cost of fluid (and IV materials, if applicable) predicted by the models to the actual cost of hospital stay from the data, if the models classified these patients as having severe dehydration. For patients classified as having some or no dehydration, the cost of hospital stay was set at zero, as both models would recommend that these patients be managed expectantly. This level of analysis estimates and compare total expenses under both models with variable clinical decisions about discharge time. Observations missing diagnostic labels for a particular model were omitted in estimating costs for that model.

Table 2. Comparison of initial recommended resuscitation estimates

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Actual Median** | **WHO Median** | **NIRUDAK Median** | **Actual IQR** | **WHO IQR** | **NIRUDAK IQR** | **Actual Total** | **WHO Total** | **NIRUDAK Total** | **Actual Obs.** | **WHO Obs.** | **NIRUDAK Obs.** |
| **All Patients** | 15.52 (1315) | 14.76 (1250) | 13.84 (1174) | 5.10 (421) | 23.32 (1990) | 34.10 (2913) | 35477 (3006578) | 40264 (3426698) | 39330 (3355529) | 2146 | 2172 | 2139 |
| **No** | 3.31 (277) | 0 (0) | 0 (0) | 3.92 (324) | 0 (0) | 0 (0) | 1719 (142815) | 0 (0) | 0 (0) | 431 | 491 | 607 |
| **Some** | 15.58 (1320) | 14.45 (1225) | 13.34 (1133) | 2.63 (218) | 1.31 (108) | 1.01 (83) | 23293 (1972312) | 13495 (1144154) | 8312 (706207) | 1437 | 937 | 624 |
| **Severe** | 38.81 (3138) | 36.04 (3073) | 34.30 (2929) | 3.79 (313) | 1.65 (136) | 1.38 (114) | 10466 (891451) | 26769 (2282545) | 31018 (2649321) | 278 | 744 | 908 |

Values were calculated by adding fluid costs to the cost of one day of hospital stay for patients classified as having severe dehydration or to the cost of eight hours of hospital stay for those classified as having some dehydration. Hospital costs for patients classified as having no dehydration were set at zero. Fluid costs and diagnostic categories were based on either the actual data or model outputs. Observations missing diagnostic labels were omitted in estimating costs for that category.