Optimal Policy: Dosage by age group

Set up

* Dosage is between 0 (zero dose) and 1 (full dose) [0.5 would be a half-dose]
* We vary the dose supply constraint along each row where the constraint is total doses divided by the population
* We use infection fatality rates by age group as a measure of the harm
* The dosage function is 0.95x^0.25 [consistent with 95% efficacy at full dose, and 80% at half-dose]
* We require efficacy to be at least 50%.

**Takeaways**:

* Give full doses to those most at risk, because a small marginal gain in efficacy is more valuable (in averting harm) for the elderly than large gains in efficacy for the young.
* At all partial dose amounts, marginal returns to dosage in harm by group must be equal.
* Results are presented for low- and high-income countries separately

1. Optimal Dosage by age group: Low Income Countries

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Age Group** | **Population Share** | ***Doses / Population*** | | | | | | | | | |
| **1.0** | **0.9** | **0.8** | **0.7** | **0.6** | **0.5** | **0.4** | **0.3** | **0.2** | **0.1** |
| 0-10 | 28.99% | 1.000 | 0.655 | 0.390 | 0.269 | 0.147 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10-20 | 23.15% | 1.000 | 1.000 | 0.900 | 0.620 | 0.340 | 0.191 | 0.102 | 0.000 | 0.000 | 0.000 |
| 20-30 | 17.28% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.868 | 0.465 | 0.322 | 0.157 | 0.000 |
| 30-40 | 12.01% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.918 | 0.635 | 0.309 | 0.109 |
| 40-50 | 8.06% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.784 | 0.382 | 0.135 |
| 50-60 | 5.32% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.456 |
| 60-70 | 3.20% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 70-80 | 1.55% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 80+ | 0.43% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

1. Optimal Dosage by age group: High Income Countries

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Age Group** | **Population Share** | ***Doses / Population*** | | | | | | | | | |
| **1.0** | **0.9** | **0.8** | **0.7** | **0.6** | **0.5** | **0.4** | **0.3** | **0.2** | **0.1** |
| 0-10 | 10.97% | 1.000 | 0.206 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10-20 | 11.27% | 1.000 | 0.886 | 0.198 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 20-30 | 12.61% | 1.000 | 1.000 | 1.000 | 0.384 | 0.136 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 30-40 | 13.73% | 1.000 | 1.000 | 1.000 | 1.000 | 0.500 | 0.271 | 0.000 | 0.000 | 0.000 | 0.000 |
| 40-50 | 13.68% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.624 | 0.159 | 0.000 | 0.000 | 0.000 |
| 50-60 | 13.34% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.420 | 0.090 | 0.000 |
| 60-70 | 11.39% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.508 | 0.143 |
| 70-80 | 8.01% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.437 |
| 80+ | 5.00% | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.972 |