Thus,

$$
\begin{aligned}
1-\beta &= P(\text{Reject } H_0 \mid H_{\text{A}} \text{true}) \\
&= P\left(\overline{X} > \mu_0 + q\frac{\sigma}{\sqrt{n}} \mid \mu = \mu_1\right) \\
&= P\left(\frac{\overline{X}-\mu_1}{\sigma/\sqrt{n}} > \frac{\mu_0-\mu_1+q(\sigma/\sqrt{n})}{\sigma/\sqrt{n}}\right) \\
&= P\left(Z > \frac{\mu_0-\mu_1}{\sigma/\sqrt{n}} + q\right) \\
&= P\left(Z > q - \frac{(\mu_1-\mu_0)}{\sigma/\sqrt{n}}\right).
\end{aligned} \tag{8.2}
$$

Thus, we see that the power of a test, $1-\beta$, is determined by the size of the lower bound of Z in Equation 8.2,

$$Z > q - \frac{(\mu_1-\mu_0)}{\sigma/\sqrt{n}}.$$

The smaller that lower bound, the larger the power. The population standard deviation σ is not controllable by the analyst. The other factors that determine the power are:

- *Effect size*: The difference between the hypothesized mean μ_0 and the actual mean μ_1. The larger the difference, the more likely we would detect the difference.
- *Denominator* $\sigma/\sqrt{n}$: The larger the sample size, the smaller the denominator and hence the larger the amount being subtracted. This too increases power.
- *Significance Level* α: Increasing α decreases the quantile q and pushes that lower bound to the left, increasing power.