Abstract: Let L be a holomorphic line bundle on a compact normal complex space X of dimension n, let $\Sigma = (\Sigma_1, \dots, \Sigma_l)$ be an l-tuple of distinct irreducible proper analytic subsets of X, and $\tau = (\tau_1, \dots, \tau_l)$ be an l-tuple of positive real numbers. We consider the space $H^0_0(X, L^p)$ of global holomorphic sections of $L^p := L^{\otimes p}$ that vanish to order at least $\tau_j p$ along Σ_j, $1 \leq j \leq l$, and give necessary and sufficient conditions to ensure that dim $H^0_0(X, L^p) \sim p^n$. If $Y \subset X$ is an irreducible analytic subset of dimension m, we also consider the space $H^0_0(X|Y, L^p)$ of holomorphic sections of $L^p|Y$ that extend to global holomorphic sections in $H^0_0(X, L^p)$, and we give a general condition on Y to ensure that dim $H^0_0(X|Y, L^p) \sim p^m$. When L is endowed with a continuous Hermitian metric, we show that the Fubini-Study currents of the spaces $H^0_0(X|Y, L^p)$ converge to a certain equilibrium current on Y, and we apply this to the study of the equidistribution of zeros in Y of random holomorphic sections in $H^0_0(X|Y, L^p)$ as $p \to \infty$. This is joint work with George Marinescu and Viêt-Anh Nguyên.