**S5 File. Computation of the distribution of the OR.**

We first condition on the set of loci which have a prescribed RAF equal to *p*. Then, we observe that

  [S32]

with  [S33]

Therefore, if is distributed according to some probability density  then, applying the change of variable formula, one deduces that  is distributed according to the density:

 [S34]

We remark from the data that  actually depends very weakly upon *p*(suppl. figure 2). We thus assume that  is independent of *p*. Denoting *(p)* the RAF probability distribution, we reconstruct the final density for  across all loci by:

 [S35]

**Suppl. figure 2.** Odds Ratios and risk allele frequencies in the general population for the disease-associated alleles reported for CD (derived from Jostins L et al. 2012).