Integration of acquired immunity into microbial risk assessment for illness incidence is of no doubt essential for the study of susceptibility to illness. In this study, a probabilistic model was set up as dose response for infection and a mathematical derivation was carried out by integrating immunity to obtain probability of illness models. Temporary acquire immunity from epidemiology studies which includes six different Norovirus transmission scenarios such as symptomatic individuals infectious, pre- and post-symptomatic infectiousness (low and high), innate genetic resistance, genogroup 2 type 4 and those with no immune boosting by asymptomatic infection were evaluated. Simulated results on illness inflation factor as a function of dose and exposure indicated that high frequency exposures had immense immunity build up even at high dose levels; hence minimized the probability of illness. Using Norovirus transmission dynamics data, results showed, and immunity included models had a reduction of 2-6 logs of magnitude difference in disease burden for both population and individual probable illness incidence. Additionally, the magnitude order of illness for each dose response remained largely the same for all transmission scenarios; symptomatic infectiousness and no immune boosting after asymptomatic infectiousness also remained the same throughout. With integration of epidemiological data on acquired immunity into the risk assessment, more realistic results were achieved signifying an overestimation of probable risk of illness when epidemiological immunity data are not included. This finding supported the call for rigorous integration of temporary acquired immunity in dose-response in all microbial risk assessments.