!! Population size doesn't change

① a) $P(T) = \frac{15}{10000} = 0,0015 = 0,15\%$

b) $P(T) = \frac{3}{10000} = 0,0003 = 0,03\%$ in 5 years

c) $R(T) = \frac{3}{10000 \cdot 5} = 0,00006 = 0,006\%$ in one year

d) $P(T) = \frac{13}{10000} = 0,0013 = 13\%$

②

	V	$\bar{V}$	Total
vaccinated	18	142	160
not vaccinated	30	40	70

a) $RR(V)_{\text{vaccinated}} = \frac{18/160}{30/70} = 0,126 \rightarrow 0,126 < 1$: being vaccinated reduces the risk of catching varicella.

b) $OR(V)_{\text{vaccinated}} = \frac{18/142}{30/40} = 0,17 \rightarrow 0,17 < 1$: being vaccinated reduces the risk of catching varicella.

c) Relative risk is more suitable as it directly compares the probability (risk) of varicella, which is exactly what is asked.

③ a) $P(+|D) = \frac{2020}{2020+140} = 0,94$

$P(-|\bar{D}) = \frac{7760}{80+7760} = 0,99$

b) $P(D|+) = \frac{2020}{2020+80} = 0,96$

$P(D|-) = \frac{7760}{7760+140} = 0,98$

	Sick D	Healty $\bar{D}$
Test +	2020 (VP)	80 (FP)
Test -	140 (FN)	7760 (VN)

c) Probability Positive diagnostic $= \frac{VP+VN}{\text{Total}} = \frac{2020+7760}{10000} = 0,98$

④ $P(V) = \frac{1}{3}$, $P(V|F) = 0{,}2$ and $P(F/V) = 0{,}1$

a) $P(V|F) = \frac{P(V) \cdot P(F/V)}{P(F)} \rightarrow P(F) = \frac{P(V) \cdot P(F/V)}{P(V|F)} = \frac{1/3 \cdot 0{,}1}{0{,}2} = 0{,}17$

b) $P(F) = P(V) \cdot P(F/V) + P(\bar{V}) \cdot P(F/\bar{V}) \rightarrow P(F/\bar{V}) = \frac{P(F) - P(V) \cdot P(F/V)}{P(\bar{V})} = \frac{0{,}17 - \frac{1}{3} \cdot 0{,}1}{2/3} = 0{,}121$

c) $P(F/V) = 0{,}1$
$P(F/\bar{V}) = 0{,}121$
} Yes, we can say the vaccine is effective as the probability of catching the flu being vaccinated is lower ($0{,}1 < 0{,}121$)