Table 1: The parameters estimation from the titre model and the threshold model using MCMC. The minimum effective sample size (ESS) is above 100 for all the variables. Burn in was 5000 steps according to the Geweke diagnostic test.

Parameters	Titre Model	Threshold Model
R_0	1.22 [1.16-1.28]	1.19 [1.16-1.25]
AbB_1	5.96 [4.98-7.00]	-
AbB_2	4.97 [4.02-6.02]	-
AbB_3	3.78 [3.03-4.60]	-
AbB_4	4.79 [2.16-7.54]	-
$TP50_1$	2.15 [0.61-5.41]	-
$TP50_2$	3.40 [0.67-9.13]	-
$TP50_3$	2.80 [0.60-9.05]	-
$TP50_4$	5.08 [0.77-9.69]	-
f_1*	5.01 [3.96-5.95]	4.57 [3.63-5.58]

Note that R_0 is defined in the presence of the initial partial immunity here.
We used uniform priors for all parameters other than f_1. * For the prior distribution of f_1, we used Gaussian distribution with mean=4 and standard deviation=0.5. See figure S5.

The prior of f_1 is set to be gaussian distributed with mean equals 5.09 derived from the xx data (ref).

The prior of f_1 is set to be gaussian distributed with mean equals 5.09 derived from the xx data (ref).

$\Delta a1$

$$DIC = P_D + \bar{D} \tag{1}$$

True Incidence $\times$ Reporting Rate = Confirmed Cases

$$Incidence(true) \times thereportingrate = Confirmedcases \tag{2}$$

$-2 \cdot log(y/\theta)$

$P_D = \bar{D} - D\bar{\theta}$

Table 2: The parameters estimation from the titre model and the threshold model using MCMC. The miminum ESS is above 100.

Parameters	Titre.Full	Titre.B	Titre.P	Titre.C	Threshold	Threshold
R_0	1.22 [1.16-1.28]	x	x	0.09[0.09-0.09]	1.19 [1.16-1.25]	
AbB	-	x	-	-	-	
AbB_1	5.96 [4.98-7.00]	-	x	6.11 [4.98-7.35]	-	
AbB_2	4.97 [4.02-6.02]	-	x	x	-	
AbB_3	3.78 [3.03-4.60]	-	x	x	-	
AbB_4	4.79 [2.16-7.54]	-	x	x	-	
$TP50$	-	-	x	-	-	
$TP50_1$	2.15 [0.61-5.41]	x	-	x	-	
$TP50_2$	3.40 [0.67-9.13]	x	-	x	-	
$TP50_3$	2.80 [0.60-9.05]	x	-	x	-	
$TP50_4$	5.08 [0.77-9.69]	x	-	x	-	
f_1*	5.01 [3.96-5.95]	x	x	1	4.57 [3.63-5.58]	
DIC	719.7	726.7	717.1	758.2	731.2	735

Table 3: The parameters estimation from the titre model and the threshold model using MCMC. The miminum ESS is above 100.

Parameters	Titre.Full	Titre.B	Titre.P	Titre.C	Threshold	Threshold.C
R_0	x	x	x	x	x	x
AbB_1	x_1	x_{1-4}	x_1	x_1		
AbB_2	x_2		x_2	x_2		
AbB_3	x_3		x_3	x_3		
AbB_4	x_4		x_4	x_4		
$TP50_1$	x_1	x_1	x_{1-4}	x_1		
$TP50_2$	x_2	x_2		x_2		
$TP50_3$	x_3	x_3		x_3		
$TP50_4$	x_4	x_4		x_4		
f_1*	x_1	x_1	x_1		x_1	

Table 4: Model comparison .

Models	Titre.Full	Titre.B	Titre.P	Titre.C	Threshold	Threshold.C
DIC	719.7	726.7	717.1	758.2	731.2	735.1
RMSE	2756.1	2675.5	2851.6	5836.4	4521.1	6535.1

Table 5: The parameters estimation from the titre model and the threshold model using MCMC. The miminum ESS is above 100.

Models	DIC	RMSE
Titre.Full	719.7	2756.1
Titre.B	726.7	2675.5
Titre.P	717.1	2851.6
Titre.C	758.2	5836.4
Threshold	731.2	4521.1
Threshold.C	735.1	6535.1

Table 6: The parameters estimation from the titre model and the threshold model using MCMC. The miminum ESS is above 100.

Parameters	Descriptions	Values
T_g	Infectious period	3.3 (day)
ω	Recovery rate	$1/25$ (day^{-1})
I_β	Protection shape	2.102
N_{tot}	Total population size	$7 \cdot 10^6$ $(person)$
I_0	Initial seeding	10 $(person)$