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EFFECTIVENESS OF COVID VACCINATION AGAINST FATALITY DUE TO COVID 19 IN KANYAKUMARI DISTRICT, TAMIL NADU - A MATCHED CASE CONTROL STUDY

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Abstract

INTRODUCTION : COVID vaccination was started in India on 16-01-21. Initially high risk groups were given priority. Since May, 2021, all adults above 18 years started receiving covid vaccination. Covishield (AZD1222) and Covaxin were used in Tamil Nadu. The study was conducted to determine the effectiveness of vaccine against fatality.

METHOD : We conducted a matched case control study based on secondary data of Kanyakumari District, Tamil Nadu. Case was any death in a COVID 19 positive individual of age more than 18 years which got documented as due to COVID illness. We selected two controls for each case matching age, sex and date of positivity. We had 94 cases and 188 controls. We calculated Odds ratio, adjusted odds ratio for protection by any COVID vaccine/ covishield.

RESULTS : Effectiveness against fatality due to covid 19 with two doses of any covid vaccine was 90% after adjusting for comorbidities; for covishield was 98%. Effectiveness against fatality of single dose of any covid vaccine was 77% and that of covishield 76%.

CONCLUSION : Two doses of any covid vaccine/ covishield could be protective against death due to covid illness for nearly all adults irrespective of their age, gender, common non communicable diseases and virulence of covid virus; even single dose could be protective for majority.

KEYWORDS : Covid vaccine, covishield, AZD1222, effectiveness against fatality, Covid 19

INTRODUCTION

COVID vaccination was started in India on 16-01-21. Initially high risk groups were given priority. Since May 20th 2021, all above 18 years were eligible to receive Covid vaccine free of cost in government health care institutions.[1]

Covishield (AZD1222) and Covaxin (BBV152) were the two vaccines widely used in Tamil Nadu. From the literature review, it was understood that efficacy/ effectiveness of AZD1222 (two doses) had been 85% to 100% against death/ severe disease, 65% to 100% against any infection and 22% against asymptomatic infection; for single dose, it was 80% to 96% against death, 75% to 92% against severe disease, 45% to 75% against symptomatic disease and 35% to 95% against any infection; regarding Delta variant, effectiveness was less by 10 to 15% after two doses & 20 to 30% after single dose.[2]

A Taiwan study suggested that a 10% increase in vaccine coverage had been associated with a 7.6% reduction in case fatality rate (3). We could find various studies eliciting vaccine efficacy/ effectiveness which fluctuated against different strains and spectrum of covid 19 virus infection. [(4), (5), (6), (7), (8)]

It was vital to arrive at the effectiveness of vaccine against fatality in field conditions because huge manpower was getting involved in vaccination programme which was having all potential to get extended for universal third dose. In a highly literate district like Kanyakumari, people had known that covid vaccination was not announced as 'mandatory'

by the Government. Our field experience suggested that people were sceptical regarding covid vaccine effectiveness as they witnessed documented covid 19 infection even after vaccination. Under such circumstances, we felt that it was essential to ascertain the usefulness of Covid vaccination in preventing covid death in Kanyakumari district. Hence the study was conducted with the following objective: To evaluate the effectiveness of COVID vaccination (for single dose and two doses) in preventing death once COVID infection and illness happens.

METHODS

We conducted a matched case control study based on data available at Covid control room of Kanyakumari District. We defined a case as any death in a COVID 19 positive individual of age more than 18 years which got documented as happened due to COVID illness during the period 15th July 2021 to Feb 10th 2022. We defined a (matched) control as any individual of age more than 18 years, who had been reported to be RT PCR positive for COVID 19 during the same day/ nearest day as that of case, belonging to same sex with nearest age.

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We excluded death not satisfying above case definition from cases. We excluded data of individuals who had been vaccinated with vaccines other than covishield or covaxin from both cases and controls. Pregnancy was exclusion criteria for both cases and controls.

For both cases and controls, we extracted data regarding status of COVID vaccination, date of first dose, date of second dose, history of comorbid illnesses (Diabetes Mellitus and Hypertension). We collected missing details like comorbidity history, date of vaccination, mobile number used for vaccination by calling the mobile number in the line list. We verified the date of vaccination in cowin website.

Case : Death due to RT PCR positive covid illness

Control : Recovery from RT PCR positive covid illness

Exposed : H/o vaccination with one or two doses of covishield/ covaxin at least 18 days before day of positivity

Unexposed : Not vaccinated against covid or vaccinated with single dose less than 18 days before date of positivity

We used epi info 7.2.5.0 for analysis. We described baseline data of cases and controls such as age, sex, comorbidity, vaccination status as mean, median, quartile deviation and proportion / percentages. We did matched analysis. We calculated Odds ratio for protection by one dose and by two doses of any COVID vaccine. We calculated Adjusted odds ratio for the above by adjusting for comorbidities like Diabetes Mellitus, Hypertension and Both. We repeated the above analysis for covishield vaccine separately after excluding all cases and controls with history of covaxin administration. We could not perform such analysis for Covaxin separately due to the fact that number of cases / controls with covaxin administration was insufficient for such an exercise. We calculated effectiveness by the formula: Vaccine effectiveness = [1- (adjusted) odds ratio] *100

We obtained ethics clearance from Institutional Ethics Committee of Tamil Nadu Public Health Department beforehand. As the study was largely based on secondary data, there were not many risks to subjects. There could be some inconvenience to the respondent while being called by mobile phone to get missing details. To minimize this risk, we requested regarding their convenient time and called at time of their choice with oral consent. We asked only the necessary questions. In case of death patients, talking about vaccination details with their family member was expected to be little sensitive; we expressed our concern regarding ascertaining the vaccine effectiveness against death from Covid; we could see the respondents answering questions with the same concern. We did not use any personal identifiers; used only codes during data entry

RESULTS

During the study period, total number of Covid 19 deaths was 98. After excluding one pregnant woman and three persons whose vaccination status was not available in records and could not be ascertained as contact numbers were also not valid, we had 94 cases and selected 188 matched controls.

Table 1: Age description of cases(Covid Death) and controls (Recovery from Covid illness)

S. No	Descriptive statistic of age	Cases (94)	Controls (188)
1	Mean	66	66
2	Median	68	67
3	Minimum	37	37
4	Maximum	88	89
5	First quartile upper limit	58	57
6	Third quartile upper limit	75	74

Cases and controls were comparable with respect to descriptive statistics of age (Table 1); proportion of males and females were also similar in both groups (Table 2). Proportion with diabetes only & hypertension only had overlapping confidence intervals; proportion of cases with history of both comorbidity & at least anyone comorbidity were higher than that of controls. Proportion of controls having history of two doses of any covid vaccine was 41% (34 to 48%) and that of cases was 9% (4% to 16%); proportion of controls with two doses of covishield was 32% (26% to 40%) and that of cases happened to be 3% (1 to 9%); proportion of one dose of vaccine among cases and controls were similar with the percentage being small in both groups (Table 2).

Table 2 : Gender, comorbidity status and vaccination status of cases (Covid Death) and controls (Recovery from Covid illness)

S. No	characteristic	Cases (94)			Controls (188)		
		No	Percentage (%)	95% CI (%)	No	Percentage (%)	95% CI (%)
1	Male sex	58	62	51 to 72	116	62	54 to 69
	Female sex	36	38	28 to 49	72	38	31 to 46
2	Hypertension only	15	16	9 to 25	22	12	8 to 17
3	Diabetes only	19	20	13 to 30	20	11	7 to 16
4	Both HT and DM	44	47	36 to 57	39	21	15 to 27
5	HT and/ or DM	78	83	74 to 90	81	43	36 to 50
6	Had one dose of any vaccine	7	7	3 to 15	18	10	6 to 15
7	Had two doses of any vaccine	8	9	4 to 16	77	41	34 to 48
8	Had one dose of Covaxin	0	0	0 to 3	1	1	0 to 3
9	Had two doses of Covaxin	5	5	2 to 12	16	9	5 to 13
10	Had one dose of Covishield	7	7	3 to 15	17	9	5 to 14
11	Had two doses of Covishield	3	3	1 to 9	61	32	26 to 40

Cases were less likely [odds ratio 0.13(0.05 to 0.30)] to be vaccinated with two doses of any covid vaccine in comparison to controls; after adjusting for diabetes, hypertension and both, adjusted odds ratio was 0.1 (0.04 to 0.28); ie, effectiveness (against fatality due to covid 19) of two doses of any covid vaccine was 90% after adjusting for comorbidities (Table 3).

Table 3: Matched Odds Ratio and Adjusted Odds ratio (Adjusted for Diabetes and Hypertension) for vaccination with any covid vaccine as exposure and death due to Covid as outcome (94 cases and 188 controls) controls (Recovery from Covid illness)

Exposure	Matched Odds Ratio	(95% CI)	P value	Final 2* log likelihood	Adjusted Odds Ratio	(95% CI)	P value	Final 2* log likelihood
Had one dose of any Covid vaccine against zero dose	0.34	0.11 to 1.03	0.057	119.22	0.23	0.06 to 0.83	0.025	87.61
Had two doses of any Covid vaccine against zero dose	0.13	0.05 to 0.30	0.000	143.12	0.10	0.04 to 0.28	0.000	104.93
Had two doses of any Covid vaccine against one dose	0.13	0.01 to 1.08	0.058	15.45	Software could not analyse due to insufficient number of suitable records			

Same way, odds of having two doses of covishield vaccine among cases was 0.03 times [odds ratio 0.03(0.004 to 0.216) lesser than that among controls. Adjusted odds ratio was 0.02 (0.002 to 0.186). Hence effectiveness of two doses of covishield was 98% after adjusting for comorbidities (Table 4)

Table 4: Matched Odds Ratio and Adjusted Odds ratio (Adjusted for Diabetes and Hypertension) for vaccination with covishield vaccine as exposure and death due to Covid as outcome (73 cases and 146controls)

Exposure	Matched Odds Ratio	(95% CI)	P value	Final 2* log likelihood	Adjusted Odds Ratio	(95% CI)	P value	Final 2* log likelihood
Had one dose of Covishield vaccine against zero dose	0.41	0.13 to 1.25	0.116	104.09	0.24	0.06 to 0.86	0.028	98.22
Had two doses of Covishield vaccine against zero dose	0.03	0.004 to 0.216	0.0005	98.22	0.02	0.002 to 0.186	0.0006	63.16
Had two doses of Covishield vaccine against one dose	0.14	0.015 to 1.184	0.0707	6.198	Software could not analyse due to insufficient number of suitable records			

Odds ratio of having one dose of any covid vaccine was 0.34 and that of covishield was 0.41; p value was more than 0.05 in both occasions. But after adjusting for two comorbidities, adjusted odds ratio was 0.23 (P value 0.025) for one dose of any covid vaccine and 0.24(P value 0.028) for that of covishield. Thus effectiveness against fatality for single dose of any covid vaccine was 77% and that of covishield was 76% (Table 3 & 4)

DISCUSSION

Cases and controls were similar with respect to age, sex and time of occurrence. Regarding distribution of Hypertension and or Diabetes, cases had higher proportion. Controls had higher proportion of history of two doses of covid vaccine especially covishield in comparison to cases.

Patients who survived were more likely to be vaccinated with two doses in comparison to who died; above relationship persisted after adjusting for comorbidities. The above was true with covishield also. One dose had been found to be protective after adjustment for common comorbidities.

Inference was that two doses of any covid vaccine/ covishield vaccine were 97%/ 98% protective against death due to Covid 19 after being infected with Covid 19 virus; similar protection by single dose was 77% / 76% respectively.

Study design (matching) eliminated the confounding effects of age, gender and virulence level of circulating virus. As the study period comprised both second and third Covid waves, matching of cases and their respective controls as per date of positivity took care of the sceptical argument of lesser mortality during third wave being attributed for less virulence of virus. Two common comorbidities were adjusted during analysis and kept away from confounding the results. Hence the association between vaccination and protection against fatality could be inferred as causal.

In a Malaysian study, effectiveness against fatality was 49% for single dose and 88% for second dose(9). In Brazil, initially people with more than 75 years of age were vaccinated. A study based on secondary data revealed that attributable protection ratio for single dose was 95% and r two doses 99%.[10] In Scotland, a cohort study estimated effectiveness against death during Delta wave as 76% for one dose and 96% for second dose.[11] In a vaccine effectiveness study conducted among health care workers and front line workers by Armed Forces Medical College faculties, they had reported that corrected Incidence Rate ratio for death was 0.13 for one dose and 0.02 for two doses.[12] Our study finding of vaccine effectiveness against fatality of 97 % was comparable to the above. A hospital based cross sectional study conducted at Delhi revealed effectiveness against mortality was 70% for single dose and 87.5% for two doses.[13] In a prospective cohort study conducted at Himachal Pradesh, there was 86% protection by single dose and 99% by two doses against unfavourable outcomes.[14] In a study conducted using the data pertaining to police personnel of Tamil Nadu, vaccine effectiveness against death was 82% for first dose and 95% for two doses.[15] The findings of that study

were quite similar to that of our study.

We expected Information bias as already available information could be more complete and accurate for death ones (cases) than recovered ones (controls). To overcome that, we called recovered individuals and family members of deceased individuals via mobile to get missing data whenever necessary. We also ascertained the vaccination status in the Cowin website. We expected uneven distribution of comorbidity among two groups as comorbid individuals were hesitant to take vaccination during initial phases of vaccination. To overcome the confounding effect of comorbidities, diabetes and hypertension were adjusted during analysis. Hence the sceptical argument of 'healthy people got vaccinated and so did not die as they were healthy' had been sincerely answered.

CONCLUSION

We concluded that two doses of any covid vaccine/ covishield could be protective against death due to covid illness for nearly all adults irrespective of their age, gender, common non communicable diseases and virulence of covid virus; even single dose could be protective for majority people.

RECOMMENDATIONS

We recommended dissemination of the above information to enhance the vaccine acceptance among comorbid individuals and vaccine sceptics who are still hesitating to have Covid vaccination and to motivate the single dose vaccinated individuals to take the second dose without delay.

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