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Original Article

A study of gender disparities towards COVID-19 vaccination drive in Maharashtra State, India

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ABSTRACT

Background and aims: India officially launched the world's biggest COVID-19 vaccination drive on January 16, 2021, operating 3006 vaccination sites at the beginning. At present 21872 sites conducting vaccination as on August 24, 2021. The process of vaccination is not yet mandatory in India. Vaccination is conducted free of cost at 20242 Government sites and paid at 1630 private sites. This study involves Hypothesis Testing for analyzing the gender disparities towards COVID-19 vaccination.
Methods: For this study, we have used Maharashtra States district wise COVID-19 vaccination data. Using Hypothesis Testing method Pearson's Chi-square test for independence compares two variables gender disparities and vaccination in a contingency table to see if they are related. To test the Effect size of gender disparities is small, medium or large Cohen Cramer's rule is used.
Results: Our result shows that, just 84 women were vaccinated for every 100 men in Maharashtra State, India. This ratio is even lower than India's gender ratio i.e. 90:100. Men were more aware and ahead of women in COVID-19 Vaccination Drive. Effect size shows that size of gender disparities is small.
Conclusion: As per the result it is seen that COVID-19 Vaccination awareness is slightly less amongst the women in Maharashtra, India. To improve this statistics of COVID-19 Vaccination, Authorities should start the awareness campaign amongst the citizen towards the importance of vaccination.

1. Introduction

In early December 2020, WHO has started the mass vaccination programme and they also administered the number of vaccination doses on a daily basis. To protect people against harmful diseases, vaccination is a simple, effective and safe way. They make your immune system stronger and use your body's natural defenses to build resistance to specific infection [1]. In India Oxford–AstraZeneca vaccine (manufactured under license by Serum Institute of India under the trade name Covishield) and Covaxin (a vaccine developed locally by Bharat Biotech) initially approved by Indian Government. COVID-19 vaccination drive launched by India on January 16, 2021 and vaccination status is monitored on daily basis using https://www.cowin.gov.in/website.

One of the studies conducted by William Joe, Assistant Professor at the Population Research Centre at the Institute of Economic Growth, Delhi suggested that in Indian women who contract COVID-19 are at a higher risk of dying than men, a recent study of cases until May 20, 2020 and they found that 3.3% of infected women died of the disease compared to 2.9% of men. It suggests that the overall risk of mortality among women is slightly higher than men [2].

One of the study conducted by Cathleen O'Grady said that "COVID-19 affects men and women differently. So why don't clinical trials report gender data?"

They further said that COVID-19 doesn't strike the sexes equally. Globally, for every 10 COVID-19 intensive care unit admissions among women, there are 18 for men; for every 10 women who die of COVID-19, 15 men die [3].

However, no such studies were conducted to analyze the gender disparities towards COVID-19 Vaccination in Maharashtra State, India. Our study focuses on identifying significant relationship between gender and vaccination efforts took place at Maharashtra.

Hypothesis:

H0. There is no association between Gender and Vaccination.

Ha. There is association between Gender and Vaccination.

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Table 1
Crosstab of District wise gender status.

District	Gender		Total
	Women	Men	
Ahmednagar	705030	875025	1580055
Akola	302881	344638	647519
Amravati	496290	544715	1041005
Aurangabad	632329	815562	1447891
Beed	398429	483175	881604
Bhandara	360225	354224	714449
Buldhana	453117	504345	957462
Chandrapur	404468	468710	873178
Dhule	366648	401312	767960
Gadchiroli	177135	200948	378083
Gondia	387090	377839	764929
Hingoli	156820	177006	333826
Jalgaon	566106	646841	1212947
Jalna	350354	400156	750510
Kolhapur	1086003	1160241	2246244
Latur	411461	482820	894281
Mumbai	3953782	5135375	9089157
Nagpur	1375600	1514595	2890195
Nanded	455776	510385	966161
Nandurbar	234631	306245	540876
Nashik	1047824	1288010	2335834
Osmanabad	253306	304180	557486
Palghar	425307	509072	934379
Parbhani	311898	342889	654787
Pune	3315339	4127279	7442618
Raigad	478685	660442	1139127
Ratnagiri	293141	342174	635315
Sangli	793588	840772	1634360
Satara	804567	858400	1662967
Sindhudurg	229564	240250	469814
Solapur	565925	678912	1244837
Thane	2013044	2428982	4442026
Wardha	334515	345863	680378
Washim	271331	304383	575714
Yavatmal	458585	525179	983764
Total	**24870794**	**29500944**	**54371738**

Table 2
Chi-square tests.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.129E4[a]	34	.000
Likelihood Ratio	8.127E4	34	.000
N of Valid Cases	5.E7		

[a] 0 cells (.0%) have expected count less than 5. The minimum expected count is 152699.1.

2. Methods

2.1. Data collection and data preprocessing

We have used the data provided by Ministry of Health and Family Welfare government website (https://www.cowin.gov.in) district wise. Maharashtra State, India divided into 35 districts and all the districts considered for the study. We have considered the data related to Men and Women those who have taken two doses or at least one dose. We have considered the data about 54371738 vaccinated men and women for our study.

2.2. Research methodology

2.2.1. Pearson's Chi-square test

The objective of study is to understand the association or significant up to August 24, 2021, relationship between gender and vaccination. India's population ratio is 94 women to 100 men according to the 2011 Censes. As per the Niti Aayog the ratio was 90 women to 100 men [4]. To test the hypothesis Pearson's Chi-square test for independence is used to compares two variables gender based differences and vaccination.

2.2.2. Cohen Cramer's rule

To test the association or significant relationship effect size is small, medium or large Cohen Cramer's rule is used. The guidelines are the same as for the equivalent phi value i.e. .10 represents a small effect, 0.30 represents a medium effect and 0.50 represents a

Table 3
Cramer's measures.

Symmetric Measures			
		Value	Approx. Sig.
Nominal by Nominal	Phi	.039	.000
	Cramer's V	.039	.000
N of Valid Cases		5.E7	

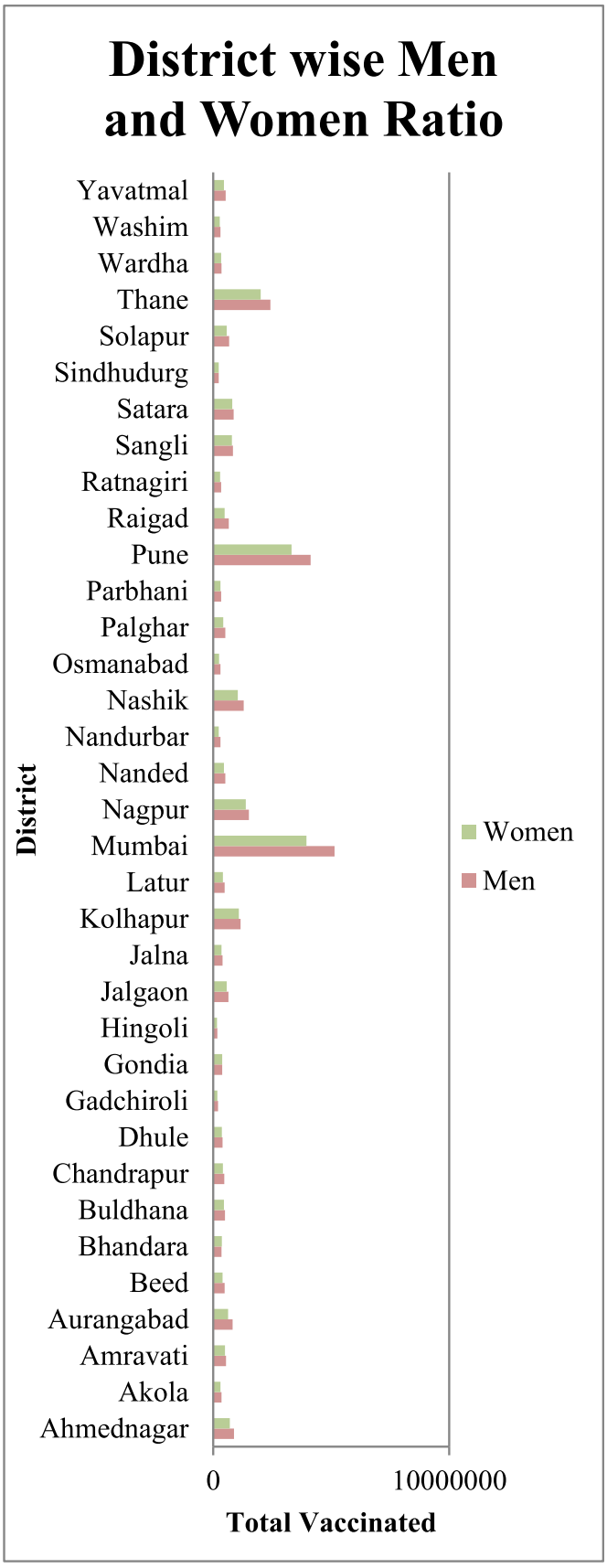

Fig. 1. District wise vaccination.

large effect between gender and vaccination [5].

3. Results

3.1. Pearson's chi-square test

We have considered the data about 54371738 vaccinated men and women for our study up to August 24, 2021. It can be inferred from Table 1 that 54.21% men and 45.70% women get vaccinated with two doses or at least one doseTable 2.

It can be inferred from Table 2 that, there is a significant relationship between gender and vaccination behavior, X^2 (34, N = 54371738) = 8.129, P = .000.

Men were more likely to engage in vaccination than were Women.

Our results show that just 84 women were vaccinated for every 100 men in Maharashtra State, India.

3.2. Cohen Cramer's rule

To test the association or significant relationship effect size is small, medium or large Cohen Cramer's rule is used.

From Table 3, it shows that Cramer's V is an effect size measurement for the chi-square test of independence.

Cramer's V = 0.039 − Small effect size in this study

4. Discussions and conclusion

From Table 1 Crosstab of District wise gender status and Fig. 1 District wise men and women ratio shows district wise vaccination, it is seen that out of 35 districts, 33 districts witness high Men: Women ratio. Only Bhandara and Gondia districts witness high Women: Men ratio.

As per the result of Hypothesis test, p = .000, which is less than 0.05 means H_0 is rejected. H_a is accepted means there is association between Gender and Vaccination. It is seen that COVID-19 Vaccination awareness is slightly less amongst the women in Maharashtra, India. To improve this statistics of COVID-19 Vaccination, authorities should start the awareness campaign amongst the citizen towards the importance of vaccination. Reduction in vaccine cost is also one way to improve vaccination. Door to door COVID-19 awareness and vaccination if possible. Increase more vaccination centers at schools and colleges.

Conflict-of-interest statement

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

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