

Rapid Review Report

Review Title:	What are the differences between COVID-19 vaccines and how they should be distributed based on population group(s)?
Abbreviated Title:	
Review ID:	EOC031001 RR
Date/Time:	March 18, 2021; 08:00 AM
Version: [to be used for updated reviews]	1
Revision History:	None
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Cite As:	Azizian, A; Shumilak, G; Lee, S; Reeder, B; Groot, G; Miller, L; Howell-Spooner, B. What are the differences between COVID-19 vaccines and how they should be distributed based on population group(s)? 2021 Mar 18; Document no.: EOC031001 RR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. 19 p. (CEST rapid review report)

Key Findings

- Current recommendations suggest phased distribution of authorized vaccines and prioritization of the recipients (e.g., health care workers, frontline essential workers, and elderly population).
- A concern that could exist with using AstraZeneca on critical populations is that it may have little coverage for mild-moderate B.1.351, which may have implications in transmission. This could be a concern in critical workforces if the variant becomes predominant, especially given the potentially higher transmissibility of variant. The literature is mixed but it is possible that AstraZeneca has lower efficacy than the mRNA vaccines.
- Canadian National Advisory Committee on Immunization (NACI) recommends that in the context of limited vaccine supply, initial doses of mRNA vaccines should be prioritized for those at highest risk of severe illness and death and highest risk of exposure to COVID-19. On the other hand, US Advisory Committee on Immunization Practices (ACIP) recommends no product preference for the vaccines.
- Just recently, NACI has expanded its recommendation for the use of the AstraZeneca vaccine to all people over the age of 18, now including those 65 years of age and over.
- While Pfizer and Moderna vaccines are mRNA vaccines and need special logistical and transportation considerations, AstraZeneca and Johnson&Johnson (J&J) vaccines are viral vector vaccines that are easier to transport.
- J&J is a single dose vaccine thus may be more appropriate in certain settings (such as homeless shelters and correctional facilities). Of note, there is no empirical evidence yet available to support this use; this suggestion is based simply on the nature of the vaccine.

Limitations

- Real world effectiveness of the four vaccines was assessed in limited number of countries. Future publications from various locations will help to better understand the vaccines' effectiveness.
- Due to the nature of the rapid review, the methodology or findings of the studies were not critically appraised.

Summative Statement – choose only one

<input type="checkbox"/> Mature evidence	<input checked="" type="checkbox"/> Emerging Supportive evidence
<input type="checkbox"/> Mixed evidence	<input type="checkbox"/> Weak evidence

Quality Assessment

Initial evidence search resulted in identification of 18 peer-review publications and 16 grey literature articles. Of these, 10 publications included for this rapid review.

Background/Context

At the time of this review, there are four COVID-19 vaccines authorized by Health Canada: Pfizer-BioNTech (BNT-162b2), Moderna (mRNA 1273), AstraZeneca (ChAdOx1), and Johnson&Johnson (Ad26.COV2.S). A comparison of vaccines differences as well as appropriate distribution policies or guidelines based on population groups seems needed.

Purpose

To summarize the vaccines' efficacy, effectiveness, dosing, and storage as well as provide evidence on distribution guidelines based on populations' characteristics (e.g., health care workers, pregnant and breastfeeding women, elderly population, etc.)

Review Question(s)

- What are the differences between COVID-19 vaccines?
- how should they be distributed based on population group(s)?

Method

For each Rapid Review, the initial question is posed by a decision-maker in the health care system seeking the evidence base for a specific policy decision. According to the subject of the question, the Evidence Task Group Intake Committee allocates this question to the appropriate Working Group. Each Working Group comprises a librarian, researcher, 1-2 clinicians, 1-2 subject matter experts, and a group leader. The Working Group and the decision-maker first discuss the question to ensure it was articulated in a clear, searchable manner. The search strategy is developed and executed by a team of medical librarians. The search is conducted in biomedical databases and also includes extensive grey literature searching. Reference lists are also reviewed for articles that may have been missed in the primary search. See Appendix for more details on the search strategies. An Evidence Search Report is thereby created. A Rapid Review of the identified literature is then performed by the researcher using the methods of a systematic review, but without a double review or meta-analysis and in a more rapid fashion. Relevant evidence is summarized in both tabular and narrative form, key findings and limitations articulated, and the quality of the body of evidence evaluated. The draft Rapid Review is reviewed and edited by the Working Group clinicians, experts, and leader. Once revisions are complete, the Rapid Review is submitted to the requesting decision-maker and placed in the COVID-19 Repository. For certain topics with rapidly changing evidence, after a period of time an updated evidence search is performed, the review process repeated, and an updated Rapid Review released.

Summary of Evidence

The Centre for Effective Practice (CEP) in Canada has summarized the current authorized vaccines' information in their website (1). The following table contains the information from their website as well as the information from other resources (2–6):

Vaccine	Overall efficacy (clinical trial data)	Effectiveness	Dosing	Storage	Vulnerable population	Pregnancy	HCW	Age
<i>Pfizer</i>	95.0%	Israel: <ul style="list-style-type: none"> • 46% and 92% for documented infection, 14-20 days after first dose and >=7 days after second dose, respectively. • 57% and 94% for symptomatic COVID-19, 14-20 days after first dose and >=7 days after second dose, respectively. • 74% and 87% for hospitalization, 14-20 days after first dose and >=7 days after second dose, respectively. • 62% and 92% for severe disease, 14-20 days after 	2 doses (21 days interval) NACI permits extending the interval to as long as four months between doses.	-80 °C to -60 °C Maximum of 6 hours from time of dilution to administration at 2°C to 25°C (new FDA announcement allows undiluted frozen vials be transported and stored at conventional freezer temperatures for a period of up to two weeks. (6))	Much of the current vaccine distribution literature is centered around the allocation of the vaccine through ethical principles, risk stratification and lessening population disease burden.	Pregnant, breastfeeding, and immunocompromised individuals can receive the vaccine with informed consent (1). It is important to know that pregnant, breastfeeding, and immunocompromised individuals were not included in the trials although there is planned follow-up of several participants that became pregnant	Priority group as per the CDC's and NACI's recommendations	>16 y/o adults; Children 12-15 must meet certain criteria including high risk for severe COVID-19.

	<p>first dose and ≥ 7 days after second dose, respectively.</p> <ul style="list-style-type: none"> • 72% in preventing death, 14-20 days after first dose. • 72% and 78% in reducing cases in individuals >60 and <60 years of age in the first two weeks after the 2nd dose, respectively. <p>UK:</p> <ul style="list-style-type: none"> • A single dose of the Pfizer (BNT162b2) vaccine is 60-70% effective at preventing symptomatic disease in adults aged 70 years and older, and 2 doses are approximately 85-90% effective. • A single dose 					following receipt of the vaccine.(7).		
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		<p>Pfizer (BNT162b2) vaccine is around 80% effective at preventing hospitalisation.</p> <ul style="list-style-type: none"> • Pfizer vaccine is 85% effective at preventing death from COVID-19. <p>Scotland:</p> <ul style="list-style-type: none"> • A single dose, 85% against COVID-19 hospitalization. • 81% against COVID-19 related hospitalisations in ≥ 80 year old adults 						
<i>Moderna</i>	94.1%		<p>2 doses (28 days interval)</p> <p>NACI permits extending the interval to as long as four months between doses.</p>	<p>-25°C to -15°C in the original carton protected from light.</p>		<p>Pregnant, breastfeeding, and immunocompromised individuals can receive the vaccine with informed</p>	<p>Priority group as per the CDC's recommendations</p>	<p>>16 y/o</p>

						consent (1). It is important to know that pregnant, breastfeeding, and immunocompromised individuals were not included in the trials although there is planned follow-up of several participants that became pregnant following receipt of the vaccine.(7).		
<i>AstraZeneca</i>	59.9%	<p>UK:</p> <ul style="list-style-type: none"> • A single dose is 60-75% effective against symptomatic disease. • A single dose is 80% effective at preventing hospitalisation. • VOC B.1.1.7 was the principal variant 	<p>2 doses (4-12 weeks interval)</p> <p>NACI permits extending the interval to as long as four months between doses.</p>	<p>Refrigerated (2 to 8°C) in the outer carton to protect from light. Do not freeze. Once punctured, can store 6 hours at room temperature up to 30°C, or 48 hours in a refrigerator (2</p>		<p>Pregnant, breastfeeding, and immunocompromised individuals can receive the vaccine with informed consent (1).</p>		<p>>18 y/o</p> <p>NACI recently expanded use of AstraZeneca vaccine to include people over 65 (8).</p> <p>Some European</p>

		<p>circulating in UK at the time of study</p> <p>Scotland:</p> <ul style="list-style-type: none"> • A single dose, 94% against COVID-19 hospitalization. • 81% against COVID-19 related hospitalisations in ≥ 80 year old adults <p>South Africa:</p> <ul style="list-style-type: none"> • SARS-CoV-2 VOC B.1.351 was the primary variant circulating at the time of the study. • 21.9% for mild-moderate symptomatic COVID-19. • 10.4% against B.1.351 variant 		to 8°C).				countries including Germany, France, Italy, and Spain have suspended use of the AstraZeneca vaccine after reports of blood clots in some recipients, however Health Canada and the European Medicines Agency did not find evidence linking the vaccine to these outcomes
<i>Johnson & Johnson</i>	66.9%		Single dose	Refrigerated (2 to 8°C) in the original carton to protect from light. Do not freeze. Once		Pregnant, breastfeeding, and immunocompromised individuals can		>18 y/o

			punctured, can store at 2°C to 8°C for up to 6 hours or at room temperature up to 25°C for up to 3 hours.		receive the vaccine with informed consent (1).		
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In the most recent vaccine statement (March 16, 2021), NACI states “while all available vaccines in Canada are safe and effective, NACI still recommends that in the context of limited vaccine supply, initial doses of mRNA vaccines should be prioritized for those at highest risk of severe illness and death and highest risk of exposure to COVID-19” (8). The Advisory Committee on Immunization Practices (ACIP) does not state a product preference for specific populations and recommends the vaccines be used when indicated for prioritized groups during any given phase (9). ACIP recommends that frontline essential workers and other essential workers receive vaccination in early phases. Examples for frontline essential workers are healthcare workers, fire service, law enforcement, correction workers, food and agricultural workers, postal service workers, manufacturing workers, grocery store workers, public transit workers, teachers, and daycare workers (9). ACIP also recommends that jurisdictions choose to vaccinate persons residing at congregate living facilities as well as the staff working in those settings (9). Communities with affected individuals in younger ages, such as American Indian and Alaska Native communities, may choose a lower age limit for vaccination prioritization (9). Some literature suggests that people provided with vaccines options are less likely to manifest vaccine hesitancy (10). However, easier transportation and single dose of Johnson&Johnson vaccine make it more desirable for mobile clinics or sites that do not have freezers (necessary for mRNA vaccines) as well as for populations with unstable social security or high turnover, such as homeless shelters or correctional facilities (9).

There is unknown efficacy against B.1.1.7 (first detected in UK) and B.1.351 (first detected in South Africa) variants for Pfizer, Moderna, Johnson&Johnson vaccines (4). Vaccine efficacy is 74.6% for AstraZeneca vaccine against symptomatic infection for B.1.1.7, but unknown for the B.1.351 (4).

Conclusions

Since the clinical trials of the vaccines have different characteristics and primary end points, it is difficult to compare the vaccines in various groups. All vaccines have high efficacy in preventing severe COVID-19 disease and death. In the context of limited vaccine supply, initial doses of mRNA vaccines should be prioritized for those at highest risk of severe illness and death and highest risk of exposure to COVID-19.

Glossary

(Optional, but useful if there are clinical/statistical terms being referenced in the document.)

Table 1: Summary of Literature

Ref	Title	Link	Key Findings	Additional findings
1	Centre for Effective Practice: COVID-19: Vaccines. March 11, 2021.	https://tools.cep.health/tool/covid-19-vaccines/	Contains summary table of four authorized vaccines' efficacy and safety.	
2	How effective are COVID-19 vaccines?	https://covid19evidencereviews.saskhealthauthority.ca/en/permalink/coviddoc273	<p>Pfizer (BNT-162b2) vaccine demonstrates 95.0% efficacy for the prevention of symptomatic COVID-19 infection occurring at least 7 days after the second dose of the vaccine (doses administered 21 days apart). Efficacy in individuals over 65 years is 94.7% and efficacy in the prevention of severe disease following the first dose is 88.9%. In a post-hoc analysis, vaccine efficacy of a single dose is 52.4% if counting cases occurring after the first dose but prior to the second.</p> <p>Moderna (mRNA-1273) vaccine demonstrates 94.1% efficacy against symptomatic COVID-19 infection occurring at least 2 weeks after the second dose of the vaccine (doses administered 28 days apart). Assessment starting 14 days after dose 1 shows 95.2% vaccine efficacy. In people older than 65 years of age, the efficacy is 86.4%. Efficacy against severe COVID-19 disease is 100% and asymptomatic disease 62%.</p> <p>AstraZeneca (ChAdOx1) vaccine demonstrates 62.1% and 90.9% efficacy against symptomatic COVID-19 confirmed by PCR in participants who received two</p>	

			standard doses (SD/SD) and in participants who received a low dose followed by a standard dose (LD/SD), respectively. Overall vaccine efficacy across both groups was 70-4%. Vaccine efficacy in preventing hospitalization, severe disease, and death was 100%.	
3	SARS-CoV-2 Vaccines: Much Accomplished, Much to Learn.	https://www.acpjournals.org/doi/10.7326/M21-0111	CDC Priorities for Distribution of COVID-19 Vaccines Cumulative incidence curves for the first COVID-19 occurrence after the first dose of mRNA vaccine.	Characteristics of the Most Advanced Vaccine Candidates for the United States
4	Where are we on vaccines and variants?	http://www.ncbi.nlm.nih.gov/pubmed/33653708	Contains summary table of main vaccines' efficacy and safety.	
5	How are other jurisdictions distributing COVID-19 vaccines in non-healthcare worker environments and what is the rationale for those distribution models?	https://covid19evidencereviews.saskhealthauthority.ca/en/permalink/coviddoc246	Consider branching out to mobile vaccination (e.g. home visits, door-to-door), pharmacies, workplaces, congregate living facilities, walk-up/drive-through mechanisms for vaccine delivery	
6	Coronavirus (COVID-19) Update: FDA Allows More Flexible Storage, Transportation Conditions for Pfizer-BioNTech COVID-19 Vaccine.	https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-allows-more-flexible-storage-transportation-conditions-pfizer	The U.S. Food and Drug Administration announced that it is allowing undiluted frozen vials of the Pfizer-BioNTech COVID-19 Vaccine to be transported and stored at conventional temperatures commonly found in pharmaceutical freezers for a period of up to two weeks.	
7	How effective are COVID-19 vaccines?		Initial findings from RCTs of the two authorized COVID-19 vaccines (Pfizer-BioNTech and Moderna) reported that the vaccines are safe. However, subsequent	

			reports show that the adverse and severe allergic reactions to these vaccines are higher than the general rates for vaccines.	
8	National Advisory Committee on Immunization (NACI): Summary of updated vaccine statement of March 16, 2021	https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/summary-updated-statement-16-march-2021.html	<p>NACI has expanded its recommendation for the use of the AstraZeneca vaccine to people over the age of 18, now including those 65 years of age and over.</p> <p>NACI has considered three recent real-world effectiveness studies to inform this change in recommendation.</p> <p>While all available vaccines in Canada are safe and effective, NACI still recommends that in the context of limited vaccine supply, initial doses of mRNA vaccines should be prioritized for those at highest risk of severe illness and death and highest risk of exposure to COVID-19.</p>	
9	Interim Considerations for Phased Implementation of COVID-19 Vaccination and Sub-Prioritization Among Recommended Populations	https://www.cdc.gov/vaccines/covid-19/phased-implementation.html#COVID19-vaccines	Any of the currently authorized COVID-19 vaccines can be used when indicated during any given phase; ACIP does not state a product preference.	
10	"Let me choose my COVID-19 vaccine."	https://linkinghub.elsevier.com/retrieve/pii/S0953620521000364	Suggests a flexible approach where most of the population will be offered and probably accept the vaccine provided by the NHS. However, when possible and as a respect for individual values and preferences, any citizen should	

			be entitled to discuss their preferred vaccine with the healthcare provider.	
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References Included in Summary

1. Vaccines at a glance [Internet]. Center for Effective Practice. [cited 2021 Mar 15]. Available from: https://tools.cep.health/wp-content/uploads/2021/03/Vaccines_Summary_r2.pdf?utm_source=link.cep.health&utm_medium=urlshortener&utm_campaign=covid-vaccine
2. Azizian A.; Reeder, B; Lee, S; Shumilak, G; Groot, G; Mueller, M; Howell-Spooner, B. How effective are COVID-19 vaccines? 2021 Mar 5; Document no.: INF122302v2 RR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. .
3. Connors M, Graham BS, Lane HC, Fauci AS. SARS-CoV-2 Vaccines: Much Accomplished, Much to Learn. *Ann Intern Med* [Internet]. 2021 Jan 19;(January):M21-0111. Available from: <https://www.acpjournals.org/doi/10.7326/M21-0111>
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6. Coronavirus (COVID-19) Update: FDA Allows More Flexible Storage, Transportation Conditions for Pfizer-BioNTech COVID-19 Vaccine. February 25, 2021. [Internet]. U.S. Food and Drug Administration. [cited 2021 Mar 16]. Available from: <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-allows-more-flexible-storage-transportation-conditions-pfizer>
7. Azizian A.; Miller, L. How effective are COVID-19 vaccines? 2021 Jan 4; Document no.: INF122302 RR. In: COVID-19 Rapid Evidence Reviews [Internet]. SK: SK COVID Evidence Support Team, c2020. 21 p. (CEST rapid review report).
8. National Advisory Committee on Immunization (NACI): Summary of updated vaccine statement of March 16, 2021 [Internet]. National Advisory Committee on Immunization (NACI). [cited 2021 Mar 17]. Available from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/summary-updated-statement-16-march-2021.html>
9. Interim Considerations for Phased Implementation of COVID-19 Vaccination and Sub-Prioritization Among Recommended Populations [Internet]. Centers for Disease Control and Prevention. [cited 2021 Mar 16]. Available from: <https://www.cdc.gov/vaccines/covid-19/phased-implementation.html# covid19-vaccines>
10. Dal-Ré R, Stephens R, Sreeharan N. “Let me choose my COVID-19 vaccine.” *Eur J Intern Med* [Internet]. 2021 Feb;(January):2020–2. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0953620521000364>

Add a section regarding notes about the quality of evidence idea

Appendix: Evidence Search Details

Search Strategies

Ovid MEDLINE(R) ALL <1946 to March 10, 2021>

#	Searches	Results
1	(coronavirus/ or betacoronavirus/ or coronavirus infections/) and (disease outbreaks/ or epidemics/ or pandemics/)	39936
2	(nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or Severe Acute Respiratory Syndrome Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2).ti,kf,nm,ox,rx,px.	101263
3	((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,kf.	12280
4	((coronavirus* or corona virus* or betacoronavirus*) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,kf. or coronavirus*.ti.	19136
5	or/1-4	114659
6	exp *Immunization/ or exp *Vaccination/ or exp *Vaccines/	224735
7	(vaccinat* or vaccine? or inoculat* or immunization? or immunize?).ti,kf.	219178
8	(vaccinat* or vaccine? or inoculat* or immunization? or immunize?).ab. /freq=2	240225
9	6 or 7 or 8	374764
10	5 and 9	4963
11	(moderna? or mrna-1273 or mrna1273).tw,kf.	215
12	(pfizer* or biontech* or tozinameran or BNT162b2).tw,kf.	3130
13	(astrazeneca or ChAdOx1-S or ChAdOx1* or COVISHIELD or (oxford and astrazeneca)).tw,kf.	1232
14	(janssen? or "ad26.cov2.s" or ad26cov2s or ad26cov2* or (johnson adj2 johnson)).tw,kf.	13295
15	11 and 12 and 13 and 14	4
16	10 and (11 or 12 or 13 or 14)	208
17	(11 and 12) or (11 and 13) or (11 and 14) or (12 and 13) or (12 and 14) or (13 and 14)	252
18	10 and 17	56
19	(allocat* or distribut* or suppl* or logistic* or organiz* or plan* or disseminat* or allot* or apportion* or assign* or decision? or deciding or compar* or contrast*).tw,kf.	9423447
20	16 and 19	64

Embase <1974 to 2021 March 10>

#	Searches	Results
1	sars-related coronavirus/	470
2	(coronavirinae/ or betacoronavirus/ or coronavirus infection/) and (epidemic/ or pandemic/)	11171
3	(nCoV* or 2019nCoV or 19nCoV or COVID19* or COVID or SARS-COV-2 or SARSCOV-2 or SARS-COV2 or SARSCOV2 or Severe Acute Respiratory Syndrome	133334

	Coronavirus 2 or Severe Acute Respiratory Syndrome Corona Virus 2 or coronavirus*).ti,ab,kw,hw,ot.	
4	((new or novel or "19" or "2019" or Wuhan or Hubei or China or Chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kw,hw,ot.	99653
5	((coronavirus* or corona virus* or betacoronavirus*) adj3 (pandemic* or epidemic* or outbreak* or crisis)).ti,ab,kw,ot.	6593
6	((Wuhan or Hubei) adj5 pneumonia).ti,ab,kw,ot.	365
7	or/1-6	133411
8	exp *immunization/ or exp *vaccine/	253358
9	(vaccinat* or vaccine? or inoculat* or immunization? or immunize?).tw,kw.	565408
10	8 or 9	606116
11	7 and 10	10194
12	(moderna? or mrna-1273 or mrna1273).tw,kw.	170
13	(pfizer* or biontech* or tozinameran or BNT162b2).tw,kw.	29445
14	(astrazeneca or ChAdOx1-S or ChAdOx1* or COVISHIELD or (oxford and astrazeneca)).tw,kw.	4126
15	(janssen? or "ad26.cov2.s" or ad26cov2s or ad26cov2* or (johnson adj2 johnson)).tw,kw.	28820
16	12 and 13 and 14 and 15	42
17	11 and (12 or 13 or 14 or 15)	194
18	(12 and 13) or (12 and 14) or (12 and 15) or (13 and 14) or (13 and 15) or (14 and 15)	3796
19	11 and 18	61
20	(allocat* or distribut* or suppl* or logistic* or organiz* or plan* or disseminat* or allot* or apportion* or assign* or decision? or deciding or compar* or contrast*).tw,kw.	12054847
21	17 and 20	47
22	16 or 17 or 19 or 21	233
23	remove duplicates from 22	229
24	limit 23 to medline	53
25	23 not 24	176

Search history sorted by search number ascending

Other Sources

vaccine AND (COVID | COVID-19) AND (allocation | distribution | logistics | rollout | roll out | administration) coronavirus | covid (moderna pfizer biontech astrazeneca janssen)

Sources

- (Particular databases, was grey literature included, etc.)
- Refer to the evidence search report for extensive sources. Be sure to include any additional resources not referenced in the evidence search report.
- This field is mandatory.



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