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Report on Owned Dog Population Survey In Zamboanga, Philippines

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INTRODUCTION

The Philippines is among the Southeast Asian countries that has a long-standing problem with rabies. About 200 people die of rabies each year in the Philippines, and most are attributed to dog bite cases (Deray, 2015). The sources of infection of more than 95% of human rabies cases worldwide have been reported to be domestic dogs (Cleaveland, *et al.*, 2006). Focusing on the main source rather than the human population, is therefore, the best strategy to eliminate rabies. The World Health Organization (WHO) recommends covering at least 70% of the existing domestic dog population with rabies vaccination in the shortest time possible (WHO, 2015). Experts and epidemiologists also recommend maintaining the population immunity above this critical level for at least twelve months, which also interrupts the transmission of rabies among the target population (Coleman & Dye, 1996; Cleaveland, *et al.*, 2003; Hampson, *et al.*, 2009; Morters, *et al*., 2013).

Campaigns to eliminate rabies in the Philippines by the year 2020 were launched by the national and local governments in the country to align with the ASEAN goal. Different sectors of the government involving the animal health industry have started to work hand in hand with the private sector, the non-government organizations, as well as with the human health industry as represented by the Department of Health (DOH). Almost all local government units (LGUs) in the Philippines now have their own programs against rabies, including mass vaccination drives, information and education campaigns, personnel trainings, spay and neuter projects, and impounding, to support the national goal. Without proper planning, coordination, and execution, these efforts are virtually ineffective against the fast-spreading rabies. Therefore, emphasis must be put on devising a good plan through tools such as a reliable dog population survey that is less constraining in terms of time, effort, and money. An accurate domestic dog population estimate is useful in planning and estimating cost and time needed to finish projects for rabies control, in managing mass vaccination campaigns, and in evaluating vaccination coverage afterwards. In the Philippines, however, most LGUs rely on the estimated dog population derived from the human population, which is just 10% of the human population. In provinces, cities, municipalities, and towns with various terrain and demography, coupled with varying human behaviour and human-dog interactions, this estimate is highly unreliable. Having the wrong estimate leads to setting wrong goals for mass vaccinations, which will most likely lead to lower vaccination coverage than the recommended level of 70% of the dog population.

OBJECTIVES

The objectives of the owned dog population survey conducted in Zamboanga were:

1. To generate an estimate of the owned dog population in Zamboanga
2. To establish a baseline in Zamboanga to complement and improve the existing dog population management and rabies control programs

METHODOLOGY

The surveys were conducted after the dog population survey training facilitated by HSI in partnership the local city veterinary office in Zamboanga The survey utilized two applications for Android smart phones that are downloadable for free from the Google Play store. These are Google Maps (Google Corporation) and OSMTracker for Android™ (Nicolas Guillaumin).

The training was conducted by HSI staff to the veterinarians and staff of the city veterinary office of Zamboanga. The trainees were taught how to design the survey, dividing the area into wards and randomly selecting which areas to be surveyed, as well as setting up the smart phones and the apps, and how to use the apps during the survey. They were also given tips on how to ask questions to get the most honest answers from the interviewees. After the day-long lectures and hands-on practice surveys, the actual survey was then done by HSI staff and Zamboanga city veterinary office personnel.

The sample size was determined using the free online sample size calculator, Raosoft®. Household sample size required to be surveyed per barangay varied from 40 to 240. This was dependent on the barangay's population density, and the number and spatial distribution of households. Depending on the spatial distribution of the barangay as viewed from the satellite image of the map, sample selection was set to every 3rd, 5th, or 10th household.

A systematic random sampling method was utilized for this survey. The group was divided into teams consisting of two people. For the actual survey, each team was assigned to different barangays, with some barangays requiring two or three teams each. Each team was assigned a barangay to survey, with 2 to 5pre-marked survey points per team. These survey points were to serve as guides for each team to avoid overlapping areas with other teams, and to avoid going out of the set boundaries for each barangay of the city. The teams were to survey a set number of households per survey point by randomly selecting each household using a pre-assigned and fixed interval of every 3rd, 5th, or every 10th household.

The teams also followed a rule of counting households on one side only (left or right), to avoid selection bias. The surveyors also walked in a zigzag pattern, going through smaller streets as well as the major streets, to cover a larger portion of the survey area which is more varied and randomly selected, and therefore, a better representative of the households in each barangay.

The following information was obtained during the household survey: number of dog-owning households, number of dogs per household, sex of the owned dogs, rabies vaccination status of the dogs and willingness of the owners to have their dogs vaccinated against rabies (if not yet vaccinated).

After each day of the survey, the data collected by each team was extracted from each phone and were analysed thereon. Each team's information from each barangay covered were checked for any errors to assure the accuracy of the survey. The numbers obtained for each barangay was derived from the resulting values of each representative barangays.

RESULTS AND DISCUSSION

This study has resulted in values of mean dog distribution ranging from19.3 to 30.2 dogs per 100 humans. This is significantly higher than the previously estimated 10% of the human population that the LGUs based their programs on.

Itis estimated from this study that there are 203,033 private dogs in Zamboanga.

An accurate estimate of the dog population is crucial in eliminating rabies, because the recommended control measures focus on the saturation of the dog population with vaccination. The 10% estimate becomes inaccurate especially in cities with highly varying human demography. An accurate estimate helps in planning a good strategy based on priority areas, and appropriations of manpower and other resources. Also, an inaccurate estimate, especially when being much less than the actual population, leads to a lesser target number, therefore in reality, not reaching the recommended 70% despite all the efforts.

Table 1. Summary table of the owned dog population survey in Rural Zamboanga

Barangay human density category (Humans per Hectare)	% Dog-owning HH	Average Dogs per HH	Dog per dog-owning HH	Owned dog population	Human population	Dogs per 100 humans
Low Density (1-10 hp per ha)	59	1.30	2.21	35274	116916	30.2
Medium Density (11-30 hp per ha)	49	1.21	2.47	64863	230056	28.2
High density (31>hp per ha)	40	0.93	2.33	16109	74672	21.6
Total				**116246**	**421644**	
Average	**49.33**	**1.15**	**2.34**	**38749**	**140548**	**26.66**

*HH = household

The data from Low Density Barangays was delivered from surveys of 36 barangays, Medium Density from 24 barangays & High Density from 9 barangays, adding up to a total of 92 barangays.

Table 2. Summary table of the owned dog population survey in Urban Zamboanga

Barangay human density category (Humans per Hectare)	% Dog-owning HH	Average Dogs per HH	Dog per dog-owning HH	Owned dog population	Human population	Dogs per 100 humans
Low Density (1-10 hp per ha)	39	0.83	2.12	54468	282910	19.3
High density (31>hp per ha)	40	0.88	2.23	32319	157245	20.6
Total				**86787**	**440155**	

Average	**39.5**	**0.86**	**2.18**	**43393**	**220077.5**	**19.95**

*HH = household

The data from Low Density Barangays was delivered from surveys of 21 barangays and the data from High Density from 8 barangays, adding up to 29 barangays.

Table 3. Summary table of the owned dog population survey in low density Rural barangays

Barangay	Population (2015)	Area (Square meter)	Area (Hectar)	HH	Humans / 100 hectare	Dogs per 100 Humans	Total Dog Population
Dulian (Upper Pasonanca)	1,325	23542200	2354.22	308	56.3	30.2	400
Taguiti	1,460	16529600	1652.96	340	88.3	30.2	441
Dulian (Upper Bunguiao)	2,570	23542200	2354.22	598	109.2	30.2	776
Lapakan	1,378	10664900	1066.49	320	129.2	30.2	416
Muti	2,983	22567300	2256.73	694	132.2	30.2	901
Calabasa	3,222	20072800	2007.28	749	160.5	30.2	973
Tumitus	3,026	16228100	1622.81	704	186.5	30.2	914
Lamisahan	2,289	12151700	1215.17	532	188.4	30.2	691
Cacao	1,347	7022800	702.28	313	191.8	30.2	407
Lubigan	2,945	15264800	1526.48	685	192.9	30.2	889
Limaong	4,000	19648400	1964.84	930	203.6	30.2	1208
Tigbalabag	1,803	8548200	854.82	419	210.9	30.2	545
Tictapul/Tictabon	3,817	16215500	1621.55	888	235.4	30.2	1153
Lumayang	1,471	5977600	597.76	342	246.1	30.2	444
Capisan	1,408	5403700	540.37	327	260.6	30.2	425
Baluno	3,155	11768500	1176.85	734	268.1	30.2	953
Tagasilay	2,971	9618900	961.89	691	308.9	30.2	897
Pasilmanta (Sacol Island)	2,122	5704000	570.40	493	372.0	30.2	641
Lanzones	3,287	8711300	871.13	764	377.3	30.2	993
Panubigan	1,610	4242600	424.26	374	379.5	30.2	486
Buenavista	6,485	15853700	1585.37	1508	409.1	30.2	1958
Licomo	5,317	12970500	1297.05	1237	409.9	30.2	1606
Bolong	6,460	15740594	1574.06	1502	410.4	30.2	1951
Dita	2,085	4402200	440.22	485	473.6	30.2	630

Manalipa	2,143	4488100	448.81	498	477.5	30.2	647
LandangGua	2,993	5702600	570.26	696	524.8	30.2	904
Sinubung	4,689	8488000	848.80	1090	552.4	30.2	1416
Victoria	2,802	5026100	502.61	652	557.5	30.2	846
Quiniput	3,329	5412300	541.23	774	615.1	30.2	1005
Mangusu	4,783	7209100	720.91	1112	663.5	30.2	1444
Latuan (Curuan)	2,457	3548700	354.87	571	692.4	30.2	742
Lumbangan	3,235	4583600	458.36	752	705.8	30.2	977
Salaan	4,073	5695300	569.53	947	715.2	30.2	1230
Cabaluay	6,350	8722986	872.30	1477	728.0	30.2	1918
Guisao	3,398	4472100	447.21	790	759.8	30.2	1026
Patalon	8,128	9891600	989.16	1890	821.7	30.2	2455

*HH = household

Table 4. Summary table of the owned dog population survey in medium density Rural barangays

Barangay	Population (2015)	Area (Square meter)	Area (Hectare)	HH	Human Population / 100 hectare	Dogs per 100 Humans	Total Dog Population
Limpapa	5,782	5597900	559.79	1345	1032.9	28.2	1631
Malagutay	6,657	6041900	604.19	1548	1101.8	28.2	1877
Bunguiao	7,287	6507300	650.73	1695	1119.8	28.2	2055
Busay (Sacol Island)	3,359	2949300	294.93	781	1138.9	28.2	947
Sibulao (Caruan)	4,244	3604100	360.41	987	1177.5	28.2	1197
Lunzuran	9,931	8001600	800.16	2310	1241.1	28.2	2801
Pasobolong	3,758	2778000	277.80	874	1352.8	28.2	1060
Tolosa	2,773	2020500	202.05	645	1372.4	28.2	782
LandangLaum	4,768	2955400	295.54	1109	1613.3	28.2	1345
Cabatangan	13,680	7933400	793.34	3181	1724.4	28.2	3858
Maasin	8,958	4646800	464.68	2083	1927.8	28.2	2526
Tumalutab	2,417	1114800	111.48	562	2168.1	28.2	682
Pangapuyan	590	254700	25.47	137	2316.5	28.2	166

Cawit	9,249	3018100	301.81	2151	3064.5	28.2	2608
Zambowood	10,166	3247500	324.75	2364	3130.4	28.2	2867
Divisoria	9,218	2670800	267.08	2144	3451.4	28.2	2599
Tulungatung	9,246	2449300	244.93	2150	3775.0	28.2	2607
Mampang	34,312	7509700	750.97	7980	4569.0	28.2	9676
Ayala	22,547	4798900	479.89	5243	4698.4	28.2	6358
Zone III	1,519	301300	30.13	353	5041.5	28.2	428
Putik	19,681	2834000	283.40	4577	6944.6	28.2	5550
Mariki	1,775	231100	23.11	413	7680.7	28.2	501
Tugbungan	23,837	2506200	250.62	5543	9511.2	28.2	6722
Guiwan	14,302	1499200	149.92	3326	9539.8	28.2	4033

*HH = household

Table 5. Summary table of the owned dog population survey in high density Rural barangays

Barangay	Population (2015)	Area (Square meter)	Area (Hectare)	HH	Human Population / 100 hectare	Dogs per 100 Humans	Total Dog Population
Kasanyangan	14,114	1104400	110.44	3282	12779.8	21.6	3049
Zone II	2,143	152800	15.28	498	14024.9	21.6	463
Santo Niño	4,129	266200	26.62	960	15510.9	21.6	892
Arena Blanco	12,589	786200	78.62	2928	16012.5	21.6	2719
Tigtabon	5,292	221714	22.17	1231	23868.6	21.6	1143
Zone I	4,112	163800	16.38	956	25103.8	21.6	888
Santa Catalina	17,294	626500	62.65	4022	27604.2	21.6	3736
Taluksangay	10,237	250707	25.07	2381	40832.5	21.6	2211
Santa Barbara	4,762	83200	8.32	1107	57235.6	21.6	1029

*HH = household

Table 6. Summary table of the owned dog population survey in low density Urban barangays

Barangay	Population (2015)	Area (Square meter)	Area (Hectare)	HH	Human Population/ 100 hectare	Dogs per 100 Humans	Total Dog Population
Vitali	9,406	34328000	3432.80	2187	274.0	19.3	1815
Talisayan	8,220	13863200	1386.32	1912	592.9	19.3	1586
Talabaan	5,340	8781700	878.17	1242	608.1	19.3	1031
Labuan	11,457	18541900	1854.19	2664	617.9	19.3	2211
Curuan	8,796	11681400	1168.14	2046	753.0	19.3	1698
La Paz	7,557	9264800	926.48	1757	815.7	19.3	1459
Pamucutan	4,059	4382400	438.24	944	926.2	19.3	783
Culianan	8,318	7927800	792.78	1934	1049.2	19.3	1605
Manicahan	10,081	9535600	953.56	2344	1057.2	19.3	1946
Boalan	8,696	7220700	722.07	2022	1204.3	19.3	1678
Mercedes	14,721	9032900	903.29	3423	1629.7	19.3	2841
Sangali	20,766	10708000	1070.80	4829	1939.3	19.3	4008
Sinunuc	16,507	7705100	770.51	3839	2142.3	19.3	3186
Zone IV	1,309	583100	58.31	304	2244.9	19.3	253
Pasonanca	27,374	8610500	861.05	6366	3179.1	19.3	5283
Rio Hondo	3,326	714100	71.41	773	4657.6	19.3	642
San Roque	27,889	4168500	416.85	6486	6690.4	19.3	5383
Santa Maria	25,185	3635200	363.52	5857	6928.1	19.3	4861
San Jose Gusu	16,723	1829400	182.94	3889	9141.2	19.3	3228
Recodo	17,395	1870400	187.04	4045	9300.1	19.3	3357
Tetuan	29,785	3149500	314.95	6927	9457.1	19.3	5749

*HH = household

Table 7. Summary table of the owned dog population survey in high density Urban barangays

Barangay	Population (2015)	Area (Square meter)	Area (Hectare)	HH	Human Population/ 100 hectare	Dogs per 100 Humans	Total Dog Population
Tumaga	30,824	2952800	295.28	7168	10438.9	20.6	6350
Camino Nuevo	7,739	738100	73.81	1800	10485.0	20.6	1594
Talon-talon	34,916	3326900	332.69	8120	10495.1	20.6	7193
Canelar	11,100	908900	90.89	2581	12212.6	20.6	2287
Calarian	28,899	2081100	208.11	6721	13886.4	20.6	5953
San Jose Cawa-cawa	6,173	388200	38.82	1436	15901.6	20.6	1272
Baliwasan	25,042	1464000	146.40	5824	17105.2	20.6	5159
Campo Islam	12,552	262600	26.26	2919	47798.9	20.6	2586

*HH = household

Based on the results, it is estimated that an average of only 35.3% of the owned dogs are vaccinated against rabies in rural Zamboanga compared with 49.5% in urban Zamboanga. For high density rural barangays, vaccination coverage was higherwith 41% of the owned dogs surveyed vaccinated compared to low density rural barangays with only 21%. A similar situation can be found in urban barangays with high density barangays having an average of 57% coverage and low density barangays having 42%. This notable difference is probably because it was easier for the provincial veterinary and municipal agriculture staff to reach high density barangays than in more rural areas wherein the households are dispersed and far apart from each other.. Most rural areas have limited access to private veterinary clinics, and have difficulty going to the province's veterinary office. Even when the veterinary office conducts mass vaccinations per barangay, some remote households are hard to reach and sometimes inaccessible because of factors such as weather and road accessibility. The results suggest that the recommended 70% vaccination saturation has not been achieved in Zamboanga, and better planning and effective implementation are required to improve the vaccination coverage.

Table 8. Summary table of dogs vaccinated against rabies in rural Zamboanga and the willingness of owners for their dogs to be vaccinated.

Density Category	Current rabies vaccination status (% coverage)	% Willing to vaccinate
Low	21	92.3
Medium	44	98
High	41	99.2
Average*	**35.3***	**96.5***

Table 9. Summary table of dogs vaccinated against rabies in urban Zamboanga and the willingness of owners for their dogs to be vaccinated.

Density Category	Current rabies vaccination status (% coverage)	% Willing to vaccinate
Low	42	99.4
High	57	96.9
Average*	**49.5***	**98.2***

The recommended vaccination coverage of 70% has been established to be adequate in rabies elimination programs worldwide (Hampson, *et al*., 2009; Lapiz, *et al*., 2012; Townsend, *et al*., 2013) and has been shown to prevent major rabies outbreaks in about 96.5% of instances (Coleman & Dye, 1996; Cleaveland, *et al*., 2003).

The willingness of the owners of unvaccinated dogs to have their dogs vaccinated against rabies in rural Zamboanga ranged from 92.3% to 99.2%, with an average of 96.5%.A similar situation occurred in urban Zamboanga with willingness ranging from 96.9% to 99.4% with an average of 98.2%. This high percentage scan be credited to the efficiency of the information drives conducted by the veterinary and agriculture offices. This also confirms that many people are aware of the dangers of rabies, but not all owners are able to bring their dogs for vaccination, or there are yet unknown factors affecting reaching the target of 70% vaccination coverage. This information may be useful in the planning of the mass vaccination drives in the future.

Figure 1. Vaccination coverage of dogs in rural Zamboanga, and % willingness of the owners to have their unvaccinated dogs to be vaccinated against rabies.

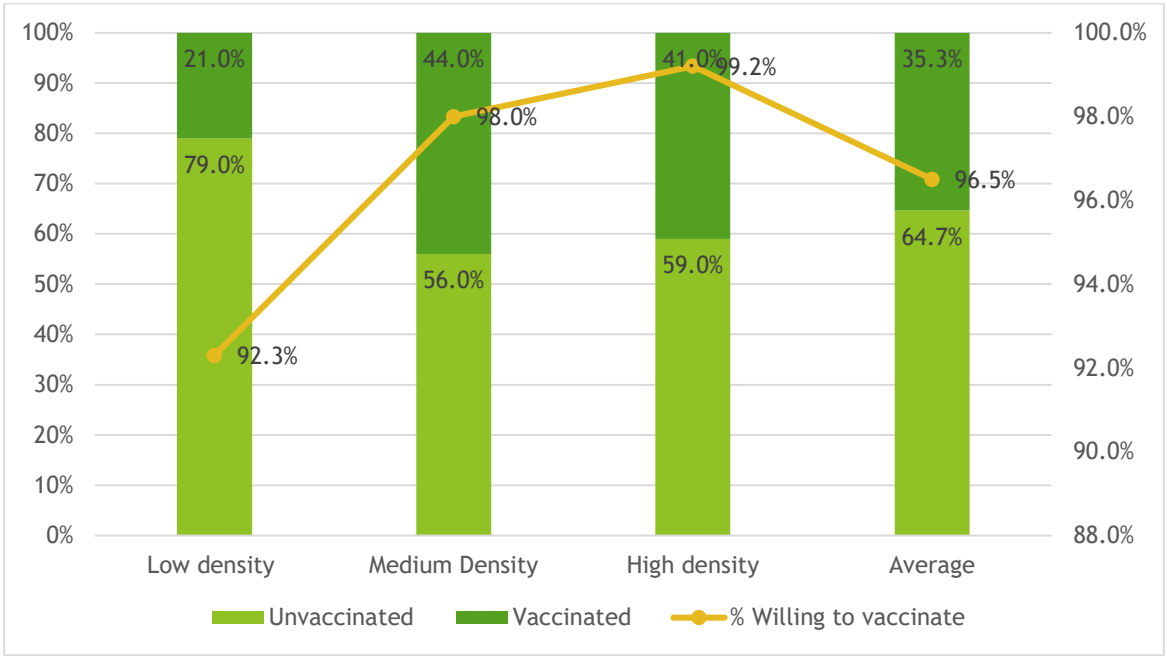
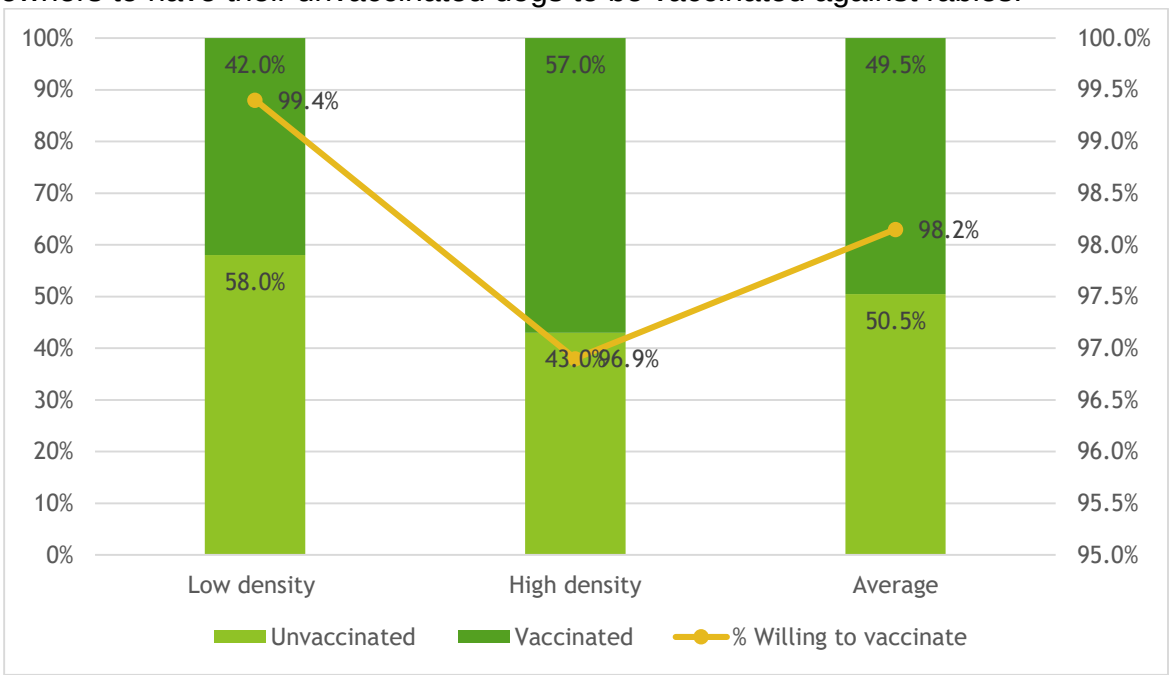


Figure 2. Vaccination coverage of dogs in urban Zamboanga, and % willingness of the owners to have their unvaccinated dogs to be vaccinated against rabies.



Surgical sterilization of dogs helps in controlling the population, and it is the more effective and humane way when compared to impounding and culling. Removal of the dogs alone is considered ineffective because it does not have a significant impact on reducing the

population densities of dogs (WHO, 2005). Furthermore, the complex interactions between dogs and humans makes the culling of free-roaming dogs ineffective regardless of the relationship between host density and the incidence of rabies (Morters, *et al*., 2013). Sterilization programs should therefore focus on sterilizing females to allocate resources strategically. The female to male dog ratio is usually skewed towards males as males are perceived as better guard dogs, however the results of this survey show that different rural and urban areas have different ratios. Low human density rural areas have hereby the highest number of males compared to females and in all other areas the number of males is slightly higher but not as significantly.

Table 10. Summary table of dog sex in rural Zamboanga

Density Category	Average percentage of female dogs	Average percentage of male dogs
Low	29	71
Medium	47	53
High	50	50
Average*	**42***	**58***

Table 11. Summary table of dog sex in urban Zamboanga

Density Category	Average percentage of female dogs	Average percentage of male dogs
Low	42	58
High	44	56
Average*	**43***	**57***

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