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Diet And Epidemiology- Their Effect On Esophageal Carcinoma

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Abstract

Oesophageal cancer is the sixth most common cause of cancer fatalities and the eighth most prevalent type of cancer overall. It is distinguished by a high death rate, a dismal prognosis at the time of diagnosis, and regional diversity. The incidence of oesophageal cancer today is changing. Even while oesophageal squamous cell carcinoma is the most common kind globally, esophageal adenocarcinoma is quickly overtaking it in wealthy nations. Low socioeconomic status is one risk factor for the development of esophageal squamous cell carcinoma. Nitrosamine intake, and use of cigarettes, alcohol, and hot beverages are also the reasons behind it. Additionally, it has been demonstrated that vitamin deficiencies contribute to the emergence of esophageal squamous cell carcinoma. These include folate, vitamins C and E. Risk factors for esophageal adenocarcinoma include Barrett's oesophagus, gastroesophageal reflux syndrome, obesity. Each year, more than 600,000 people worldwide receive an esophageal cancer diagnosis, and the five-year survival rate is less than 20%. There are significant regional differences in the incidence rates of the two common histological subtypes of esophageal Cancer, esophageal squamous cell carcinoma (ESCC) and esophageal adenocarcinoma (EAC). Early detection and screening are key to lowering the incidence and mortality of advanced Esophageal Cancer. There are currently no standards for esophageal squamous cell cancer screening. There are currently no standard guidelines for the early detection of esophageal squamous cell carcinoma. Though there is more clear data in the form of randomised controlled trials, guidelines for esophageal cancer are less well defined.

Keywords: Esophageal Cancer, Diet, Lifestyle, Factors, Prevalence, Worldwide

INTRODUCTION:

Esophageal Squamous Cell Carcinoma (ESCC) or Esophageal Adenocarcinoma (EAC), which are malignant tumours arising from the esophageal epithelium, make up the majority of esophageal cancers (EC). According

to global epidemiological data from 2020, EC ranks sixth overall in terms of overall mortality (544,076 fatalities) and seventh in terms of incidence (604,100 new cases). A consistent decrease trend in recent years has been observed in the incidence rate of Esophageal cancer. Although its mortality is still high, just 20% of patients survive for five years, which is the second-lowest survival rate after pancreatic cancer (at 10%) (Li *et al.*2021).

In the US, esophageal malignancies are distributed as follows: 64% are adenocarcinomas, 31% are squamous cell carcinomas, and 5% are basal, transitional, and other unspecified carcinomas. Particularly in early-stage disease, Esophageal Adenocarcinoma often has a greater overall median survival than Esophageal Squamous Cell Carcinoma. Although the precise mechanism of malignant transformation is not entirely understood, it is believed that Esophageal Adenocarcinoma is related to Barrett's oesophagus and typically arises in the distal third of the esophagus and at the gastroesophageal junction (GEJ). A patient with Barrett's esophagus has a 30- to 40-fold higher risk of developing Esophageal Adenocarcinoma. Esophageal Squamous Cell Carcinoma is frequently discovered reciprocally in the proximal two-thirds of the esophagus (Uhlenhopp *et al.*2020).
The overall 5-year survival rate for patients with esophageal cancer is less than 20%, though the Fluorouracil plus Leucovorin, Oxaliplatin, and Docetaxel (FLOT) and Chemo Radiotherapy for Esophageal cancer Followed by Surgery Study (CROSS) improved the rate to 47% and 45%, respectively (Shapiro *et al.*2015, Al-Batran *et al.*2019).

Monitoring the epidemiological trend of esophageal cancer is essential because it can guide the development of efficient clinical and public health interventions and offer etiological hints. Due of the significant variation in epidemiology amongst the various populations, aPlanning and allocating resources could be aided by a thorough examination of the disease's worldwide burden and current developments utilising high quality cancer registry data. The updated incidence of esophageal subtypes and their related avoidable risk factors must be determined because Esophageal Adenocarcinoma and Esophageal Squamous Cell Carcinoma require different preventive approaches and clinical care. However, only a small number of research examined the prevalence of esophageal cancer worldwide by histological subtypes, related risk factors, and current epidemiological trends (Arnold *et al.*2015, Arnold *et al.* 2020).
There is little consensus on the cause of EC. Early EC has no distinct clinical signs, therefore most patients who missed the chance for an early diagnosis are frequently diagnosed at an advanced stage, which has a negative impact on quality of life and the prognosis. A set of recommendations for the detection and monitoring of Barrett's esophagus (BE) and Esophageal Adenocarcinoma have been developed by the British and American Societies of Gastroenterology (Li *et al.* 2021)

DISCUSSION:

INCIDENCE: Esophageal cancer is more common in some places than others and among different cultures. According to estimates, 570,000 persons were anticipated to have received an esophageal cancer diagnosis in 2018, accounting for 3.2% of all cancer diagnoses. Approximately 87% of esophageal malignancies in the world are Esophageal Squamous Cell Carcinoma, and 11% are Esophageal Adenocarcinoma. The most typical cancer diagnosis in Malawi is esophageal carcinoma, it should be noted. Around 78% of all esophageal cancer cases occurred in the continent of Asia. Chinese courts handled 49% of all cases. The incidence of esophageal cancer in the US (5.6 per 100,000) is lower than the global average (9.3 per 100,000), and in the US, Caucasians made up the majority of cases (85%) of the 27,340 histological confirmed cases between 2012 and 2016 (Bray *et al.* 2018)

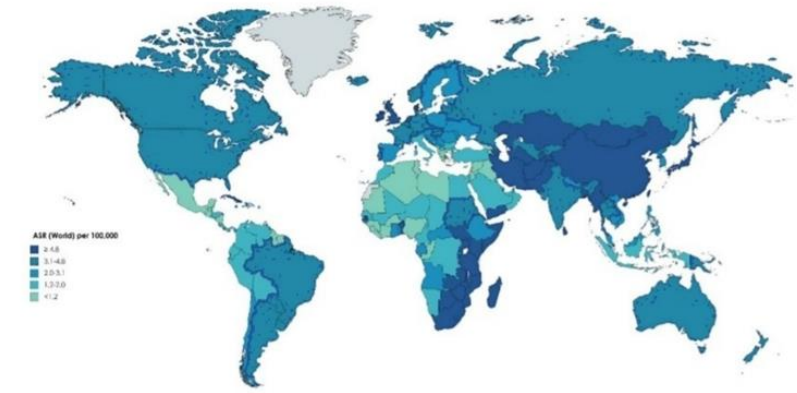

Fig. 1: Global map showing age-standardised incidence rates for esophageal cancer

RISK FACTORS:

FAMILY HISTORY: There have been conflicting reports on the familial risk of esophageal cancer. Studies conducted in the United States, Italy, and Switzerland failed to find any correlation. However, research in China (a nation with far higher prevalence of ESCC) showed that people with a familial history of ESCC in a first-degree relative have approximately quadrupled their risk of developing the condition. These people also often have lower survival rates. Due to their astoundingly enhanced chance of acquiring solid tumours, individuals with the rare autosomal recessive genetic condition Fanconi anaemia have a several hundred- to several thousand-fold higher risk of developing esophageal cancer (Uhlenhopp *et al.* 2020)

OBESITY: A dose-dependent relationship between the risk of EAC and rising BMI or waist circumference appears to exist (Huang *et al.* 2018). When compared to people with BMI 25, those with a BMI > 40 had a twofold greater risk of developing EAC, and this link holds true regardless of GERD symptoms (Hoyo *et al.* 2012)

ALCOHOL: Geographically, the proportion of ESCC owing to population-level alcohol intake can vary greatly. 72.4% of ESCC cases in the USCases are ascribed to alcohol but just 10.9% of cases in China are, which is probably a reflection of exposure levels. Depending on weekly alcohol consumption, relative hazards range from 1.8 to 7.4 (Domper Arnal *et al.* 2015).

TOBACCO: Smoking has continuously been identified as a significant risk factor for ESCC in prospective epidemiological data, and this risk appears to be dose dependant. This has been shown in studies in varied degrees across Africa, Asia, Europe, and the US, indicating that this risk factor is not a regional phenomenon. An OR of 21.9 for ESCC with combined cigarette and alcohol usage was discovered in another Australian investigation. Former smokers are still smoking even ten years after they stopped. Compared to non-smokers, are twice as likely to develop ESCC (Uhlenhopp *et al.* 2020).

***Helicobacter pylori* INFECTION:** Gastric *Helicobacter pylori* infection lowers gastric acid output. Despite contradicting research, the lack of *H pylori* infection may be a risk factor for adenocarcinoma. Significantly negative correlations between the presence of *H pylori* infection and adenocarcinoma (OR 0.52) and BE (OR 0.64) were discovered, pointing to a preventive rather than carcinogenic role for *H pylori* in stomach cancers.

DIABETES ASSOCIATION: The risk of having EC may be up to 28% higher in the group of diabetics. The relationship between diabetes mellitus and cancer is hyperglycemia. The crosstalk between oxidative stress and the advanced glycation products/advanced glycation products receptor system can be influenced by hyperglycemia. Inhibiting apoptosis and promoting cellular proliferation are two effects of the crosstalk that may result in cancer and cell invasion (Xu *et al.* 2017).

DIETARY FACTORS: A meta-analysis of 32 trials on fruit and vegetables found that eating a lot of them protects against ESCC. The authors advise against placing too much emphasis on specific intake criteria, but

they do imply that significant thresholds of 160 g/day of non-starchy vegetables and 20 g/day of fruits had a protective benefit (Liu *et al.* 2013).

HOT DRINKS CONSUMPTION: There is strong proof that drinking maté the traditional South American way—with boiling hot beverage down a metal straw—increases the risk of esophageal cancer in a reliable dose-dependent manner. This finding may be related to the heat-induced epithelium damage rather than the maté itself. Additional research has shown that people who consume hot foods and beverages, especially in Asian and South American cultures, are approximately twice as likely to get esophageal cancer (Chen *et al.* 2015).
Due to direct thermal stimulation, consuming hot foods may cause the esophageal mucosa to become carcinogenic. These effects are more common in the upper oesophagus than the lower oesophagus (Zhao *et al.* 2020).

BETEL NUT CHEWING: In one study, the effects of chewing betel nuts were analysed. Natural masticatory betel nuts are derived from the fruit's seed of the Areca catechu original palm. Chewing betel nuts is a widespread habit in Southeast Asia, particularly in Taiwan. The risk of EC was similar for betel nut chewers and non-chewers, but it was noticeably higher for those who chewed with a piece of betel inflorescence and ingested betel-quid juice (Zhao *et al.* 2020).

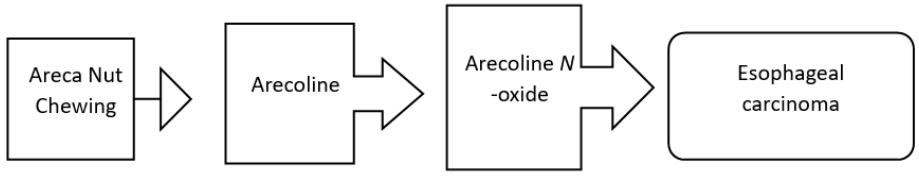

Fig. 2: Flowchart showing the carcinogenic effect on Betel quid chewing

PROCESSED MEAT INTAKE: Red, salted, or processed meat consumption can raise ESCC risk by up to 57%, with a nonsignificant rise in risk for EAC. However, demographic studies have revealed a link between a meat-heavy diet and an increase in Barrett's oesophagus, a precursor for EAC (Uhlenhopp *et al.* 2020). Fresh meat or fat is stored in salt for 7 days before being air-dried for 2 months to produce salted meat or fat. The salted meat and fat are then consumed all year round in Yanting by locals. N-nitroso compounds, which have been shown to be carcinogenic in animals and possibly in humans, are created during the production and storage operations. Furthermore, salted meat may include additional carcinogens including polycyclic aromatic hydrocarbons and heterocyclic amines, especially when cooked or processed at high temperatures. In China, fast food meat products have significant levels of heterocyclic amines (Zhao *et al.* 2019).

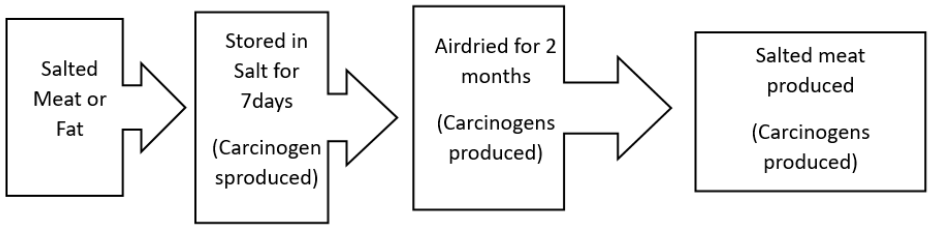

Fig. 3: Flowchart showing carcinogens production during the procedure of salted meat

HIGH SPICE INTAKE: The current study, which includes 25 studies from 5 countries, is the largest and most recent meta-analysis of the association between the progression of EC and consumption of spicy food. 515,397 cases made up the control group and 7810 cases made up the case group. According to the findings, those who consumed the spiciest food had a 70% higher risk of developing EC than those who consumed the least (Xie *et al.* 2022).

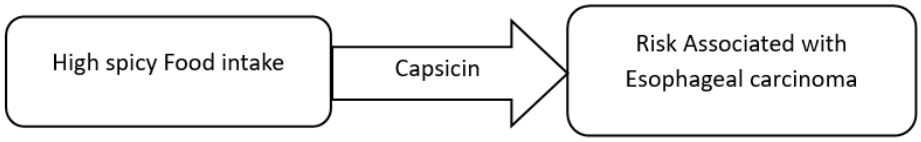

Fig. 4: Figure showing the causative factor present in spicy food contributing to esophageal cancer

SODIUM INTAKE: The case-control studies demonstrated a positive correlation between dietary salt intake and the risk of EC in the random-effects model. The pooled odds ratio (OR) of the greatest level of dietary salt intake was 1.97 (95% CI, 1.49-2.61), with significant heterogeneity among the trials (Q statistic 14 105.97, P 0.001, I 2 14 82.1%) (Banda *et al.* 2019).

Study	Upper Limit	Lower limit	Z value	P value
Dar *et al.* 2015	4.019	1.681	4.293	0.000
Lin *et al.* 2015	8.729	3.488	7.295	0.000
Sehgal *et al.* 2013	4.289	1.491	3.441	0.001
Shah *et al. 2018*	8.656	4.666	11.709	0.000

Table 1: Tabular representation of various studies showing the impact of sodium intake on occurrence of esophageal cancer

Authors	Participants	Objective	Findings
Oze *et al.* (2013), Japan	Cases—961patients;562were≥60 y;434withEsophagealcancer.Control - 2,883non-cancerpatients;1676 were 60 and older	To evaluate the possible anticarcinogenic properties of the ingredients of coffee and green tea.	Drinking three or more cups of coffee each day may reduce your risk of developing head and neck cancer (UADT), however drinking three or more cups of green tea may raise your risk of developing the disease. Green tea and coffee are not linked to esophageal cancer.
Lin *et al* (2015), China	Cases—942patients with ESCC. Control—942; age and sex matched. Mean age is 60 y.	To evaluate the Association between salted meat intake and ESCC and to explore its joint effects with alcohol drinking and smoking	A weekly intake of 50 g of salted meat was associated with an 18% higher risk. Meat that has been salted and either alcohol The risk was higher from drinking or smoking than from salty meat alone. The three factors together showed the strongest correlation, especially at the highest level of consumption of salted meat.
Yokoyama *et al. (*2017), Japan	Subjects—278 Male patients; 231 were ≥60 y.	To use the health risk appraisal model in predicting the risk of ESCC based on drinking,smoking,dietary habits, and alcohol flushing	The high-HRA score group, or group with scores of >12, was characterised by greater preference for drinking strong alcoholic beverages straight, heavier alcohol consumption, especially among current or former flushers, more cigarette smoking, and less consumption of green and yellow vegetables and fruit.

Table 2: Tabular representation of findings of various studies of risk factors associated with Esophageal Cancer in Asians

CONCLUSION:

Esophageal cancer still accounts for a significant portion of cancer-related fatalities globally. Since the 1970s, survivability has been gradually increasing, but 5-year survival rates are typically remained under 20%. Esophageal cancer is frequently discovered in its advanced stages, when there are few choices to increase survival time past a few months. In the US, fewer than one in every five cases of esophageal cancer are discovered when it is still treatable, and the median survival time for those with advanced cases is only 6 to 13 months. Eighty percent of cases of Esophageal Adenocarcinoma, the most frequent kind of esophageal cancer in the US, are caused by GERD, obesity, smoking, and a low diet of fruits and vegetables. Nearly 90% ofEsophageal Squamous Cell Carcinoma instances in the US are caused by using tobacco, drinking alcohol, and eating little fruits and vegetables

The exclusion of very hot meals and drinks from the diet along with the cessation of alcohol and cigarette use are likely to offer the most behavioural modification benefits when it comes to esophageal cancer preventive techniques. Increasing one's intake of fruits and vegetables would probably be beneficial, but may be challenging in underdeveloped nations, where more than 80% of Esophageal Squamous Cell Carcinoma deaths occur.

For esophageal cancer screening, a number of biochemical markers, optic-based chromo endoscopic techniques, and balloon cytology have been investigated; however, as of right now, no single technique has

achieved the sensitivity, specificity, or economic viability necessary for widespread population-based application. Such a programme needs to take psychological and financial effects into account. Risk factor models will probably play a significant role in any future recommendations for Esophageal Squamous Cell Carcinoma screening in order to determine who is most at risk and needs to be screened. One study on Japanese males used health risk evaluation models that took into account the ALDH2 genotype, alcohol, tobacco, and food and referred those who were found to be in the top 10% risk group for endoscopy with iodine staining. Eight times the national average, their models could identify up to 3.13% of Esophageal Squamous Cell Carcinoma; significantly, these tumours were identified at an earlier stage.

With more recent technology, open surgery is no longer necessary to treat the premalignant lesions of esophageal cancer. For people who are at high risk for both Esophageal Squamous Cell Carcinoma and Esophageal Adenocarcinoma, population-based targeted screening endoscopy would be possible in terms of enhancing survival and being cost-effective. Future research should examine the causes of these epidemiological shifts and the cost-effectiveness of various preventative measures, which may provide more details on the aetiology and treatment of individual histological subtypes of esophageal cancer. The preventable cancer mortality rate has significantly increased as a result of the recent COVID-19 outbreak. It is still unknown how it may impact Esophageal Squamous Cell Carcinoma and Esophageal Adenocarcinoma epidemiology globally in the near future.

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CONFLICT OF INTEREST:

There is no conflict of interest related to the study.

REFERENCE:

1. Al-Batran, S.E., Homann, N., Pauligk, C., Goetze, T.O., Meiler, J., Kasper, S., Kopp, H.G., Mayer, F., Haag, G.M., Luley, K. et al. (2019). Perioperative chemotherapy with fluorouracil plus leucovorin, oxaliplatin, and docetaxel versus fluorouracil or capecitabine Plus cisplatin and epirubicin for locally advanced, resectable gastric or gastro-oesophageal junction adenocarcinoma (FLOT4): A Randomised, phase 2/3 trial. Lancet. VOLUME 393, ISSUE 10184, P1948-1957, DOI: https://doi.org/10.1016/S0140-6736(18)32557-1
2. Arnold, M., Ferlay, J., van Berge Henegouwen, M.I., Soerjomataram, I. et al. (2020). Global burden of oesophageal and gastric cancer by Histology and subsite in 2018. Gut. 69(9):1564-1571, doi: 10.1136/gutjnl-2020-321600.
3. Arnold, M., Laversanne, M., Brown, L.M., Devesa, S.S., Bray, F. et al. (2017). Predicting the Future Burden of Esophageal Cancer by Histological subtype: International Trends in Incidence up to 2030. Am. J. Gastroenterol. 112(8):1247-1255. doi: 10.1038/ajg.2017.155.
4. Banda, K., Chiu, H., Hu, S., Yeh, H., Lin, K., Huang, H. et al. (2019). Associations of dietary carbohydrate and salt consumption with Esophageal cancer risk: a systematic review and meta-analysis of observational studies. Nutr. Rev. 78(8):688-698. doi: 10.1093/nutrit/nuz097.
5. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L. et al. (2018). Global cancer Statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 68(6):394-424. doi: 10.3322/caac.21492.
6. Chen, Y., Tong, Y., Yang, C. et al. (2015). Consumption of hot beverages and foods and the risk of esophageal cancer: a meta-analysis of observational studies. BMC cancer. 15:449. doi: 10.1186/s12885-015-1185-1.
7. Domper Arnal, M.J., Arenas, F., Arbeloa, L. et al. (2015). Esophageal cancer: Risk Factors, screening and endoscopic treatment in Western and Eastern countries. World J Gastroenterol. 21(26):7933-43. doi: 10.3748/wjg.v21.i26.7933.

8. Hoyo, C., Cook, M.B., Kamangar, F. et al. (2012). Body mass index in Relation to oesophageal and oesophagogastric junction adenocarcinomas: a pooled analysis from the International BEACON Consortium. Int J Epidemiol. 41(6):1706-18. doi: 10.1093/ije/dys176.
9. Li, J., Xu, J., Zheng, Y., Gao, Y., He, S., Li, H., Zou, K., Li, N., Tian, J., Chen, W., He, J. et al. (2021). Esophageal cancer: Epidemiology, risk factors and screening. Chin J Cancer Res. 33(5): 535–547. doi: 10.21147/j.issn.1000-9604.2021.05.01.
10. Lin, S., Wang, X., Huang, C. et al. (2015). Consumption of salted meat and its interactions with alcohol drink and tobacco smoking on esophageal squamous cell carcinoma. Int J Cancer. 137(3):582-589.
11. Liu, J., Wang, J., Leng, Y., et al. (2013). Intake of fruit and vegetables and Risk of esophageal squamous cell carcinoma: a meta-analysis of Observational studies. Int J Cancer. 133(2):473-85. doi: 10.1002/ijc.28024.
12. Shapiro, J., van Lanschot, J.J.B., Hulshof, M., van Hagen, P., van Berge Henegouwen, M.I., Wijnhoven, B.P.L., van Laarhoven, H.W.M., Nieuwenhuijzen, G.A.P., Hospers, G.A.P., Bonenkamp, J.J. et al. (2015). Neo adjuvant chemoradiotherapy plus surgery versus Surgery alone for oesophageal or junctional cancer (CROSS): Long-term results of a randomised controlled trial. Lancet Oncol. 16(9):1090-1098. doi: 10.1016/S1470-2045(15)00040-6.
13. Uhlenhopp, J.D., Then, O.E., Sunkara, T., Gaduput, V. et al. (2020). Epidemiology of esophageal cancer: update in global trends, etiology and risk factors. Clin J Gastroenterol. 13(6):1010-1021. doi: 10.1007/s12328-020-01237-x.
14. Xie, P., Xia, W., Lowe, S., Zhou, Z., Ding, P., Cheng, C., Bently, R., Li, Y., Wang, Y., Zhou, Q., Wu, B., Gao, J., Feng, L., Ma, S., Liu, H., Sun, C. et al. (2022). High spicy food intake may increase the risk of esophageal cancer: A meta-analysis and systematic review. Nutr. Res. 107:139-151. doi: 10.1016/j.nutres.2022.09.006.
15. Xu, B., Zhao, X., Li, X., Liu, C.., Yang, C. et al. (2017). Diabetes mellitus carries a risk of esophageal cancer. Medicine (Baltimore). 96(35):e7944. doi: 10.1097/MD.0000000000007944.
16. Yokoyama, A., Katada, C., Yokoyama, T. et al. (2017). Alcohol abstinence and risk assessment for second esophageal Cancer in Japanese men after mucosectomy for Early esophageal cancer. PLos One. 12(4):e0175182. doi: 10.1371/journal.pone.0175182.
17. Zhao, L., Li, Y., Wu, J., Zhao, Y., Wang, R., Jiang, M., Song, Q. et al. (2019). Increased risk of esophageal squamous cell carcinoma associated with frequent and Long-term consumption of Salted meat and salted fat. Journal of International Medical Research. Vol. 47(8) 3841–3849.
18. Zhao, X., Lim, F. et al. (2020). Life style risk factors in esophageal cancer- An Integrative Review. Crit Care Nurs Q. Vol. 43, No. 1, pp. 86–98. doi: 10.1097/CNQ.0000000000000295.