

Evaluation of serum Prostate Specific Antigen in Elderly Men with Type 2 Diabetes

Manoj Acharya^{1,2}, Binod Kumar Lal Das², Madhab Lamsal², Bishal Khattri², Rikesh Jung Karkee³, Sneha Sinha⁴, Nirmal Baral⁵

¹ Department of Biochemistry, Rapti Academy of Health Sciences, Dang, Nepal

² Department of Biochemistry, B.P. Koirala Institute of Health Sciences, Ghopa, Dharan, Nepal

³ Department of Surgery, B.P. Koirala Institute of Health Sciences, Ghopa, Dharan, Nepal

⁴ Department of Biochemistry, Madhesh Institute of Health Sciences, Janakpur, Nepal

⁵ Department of Biochemistry, B & C Medical College and Teaching Hospital, Birtamode, Jhapa, Nepal

Article Info:

Received Date: September 2025

Acceptance Date: March 2026

Corresponding Author:

Dr. Manoj Acharya

Lecturer

Department of Biochemistry

Rapti Academy of Health Sciences,

Ghorahi, Dang, Nepal

Email: mannose24@gmail.com

Funding sources: None

Conflict of interest: None

Access the article online



DOI: 10.70027/jrahs97

Abstract

Introduction: Prostate-specific antigen is a vital marker while evaluating prostate health, mainly in diagnosing prostate cancer. However, alterations of PSA in men with type 2 diabetes may affect the accuracy of determining the risk of prostate cancer. There are evidences that males with type 2 diabetes have a reduced incidence of prostate cancer, despite the fact that type 2 diabetes is linked to an increased risk of cancer, including pancreatic, liver and breast. The main objective of our study is the comparison of serum PSA levels in elderly males with and without type 2 diabetes mellitus.

Methods: A comparative, cross-sectional study for duration of six months was conducted in Surgery OPD of B.P Koirala Institute of Health Sciences with participation of 100 males aged 40 and older; fifty of them had diabetes and the other fifty did not. Immunoturbidimetry and chemiluminescence immunoassay (CLIA) were used to evaluate the levels of HbA1c and serum PSA, respectively. Statistical analysis was performed using the Mann-Whitney U test, chi-square test and Spearman correlation.

Results: This study included male participants aged 40 years and older, with and without diabetes. Participants with diabetes had median PSA levels that were significantly lower (0.92 ng/mL) than those without the disease (1.1 ng/mL; $p = 0.01$). Correlation analysis showed that PSA levels of subjects was positively correlated with age ($r = 0.31$, $p = 0.002$), while PSA was correlated negatively with HbA1c ($r = -0.27$, $p = 0.007$).

Conclusion: Our study found that men with Type 2 diabetes have lower serum PSA levels than men without diabetes. These findings advise taking type 2 diabetes status into account when interpreting PSA values in prostate cancer screening.

Keywords: Prostate specific antigen; type 2 diabetes; prostate cancer

Introduction

Numerous studies have shown that individuals with diabetes have an increased risk of developing certain cancers, such as those of the pancreas, colon and liver,

potentially due to hyperglycemia however, the relationship between diabetes and prostate cancer appears to be different from that observed with other cancers. Some studies have reported that men with diabetes may have a reduced risk of developing prostate cancer when

Citation:

Acharya M, Das BKL, Lamsal M, Khattri B, Karkee RJ, Sinha S, et.al. Evaluation of serum Prostate Specific Antigen in Elderly Men with Type 2 Diabetes. JRAHS Journal of Rapti Academy of Health Sciences. 2025;2(2):40-44.

Copyright:

© Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under Creative Commons Attribution License CC - BY 4.0

compared with non-diabetic men, suggesting a possible inverse association between these two conditions.^{1,2} Prostate-specific antigen (PSA), a glycoprotein produced by the prostate gland, is widely used as a biomarker for prostate cancer screening and prognosis.³ There are only limited studies indicating an inverse relationship between type 2 diabetes and PSA levels.^{3,4} Long-term diabetic men exhibiting lower PSA and prostate cancer risk compared to non-diabetics, while recently diagnosed diabetic men may have an elevated risk.⁴ Additionally, evaluating glycemic control using HbA1c rather than just diabetes status may provide deeper insight, though existing studies on this topic remain limited and inconclusive.⁵ Understanding the inverse effect of diabetes on PSA serum concentration can aid in clinical detection of prostate cancers and positive results may help adjust the PSA cut-off value during screening.

Methods

A hospital-based, comparative cross-sectional study was conducted at B.P. Koirala Institute of Health Sciences (BPKIHS), Nepal, starting from April 2023 to December 2024. The study was carried out in collaboration with the Department of Biochemistry and Surgery. The Institutional Review Committee (IRC), code number IRC/2558/023, granted the ethical clearance.

A total of 100 participants (50 men Diabetic and 50 men Non-diabetic) were enrolled through purposive sampling from the Surgery OPD after obtaining written informed assent from participants, provided in the local language. The sample size was calculated using formula for comparing the difference between means. Study done on 2017 by Al-Asadi, et al. shows the mean total PSA on diabetic cases being 1.97 ng/mL (SD +/-1.05)⁶.

$$N = 2 \times (SD)^2 [\alpha + \beta]^2 / (X1 - X2)^2$$
$$= 2 \times (1.13)^2 [1.96 + 0.8]^2 / (1.97 - 2.60)^2$$
$$= 49.14$$

Inclusion criteria comprised elderly male patients more than 40 years of age, with an IPSS (International Prostate Symptom Score) of 0-7 (mild). Exclusion criteria comprised individuals with clear prostate disease, latest prostate manipulation, PSA more than 6.5ng/ml and those who do not agree to participate.

Threemilliliters (ml) of whole blood samples were collected from the participants in plain vials for biochemical tests. Blood samples were allowed to centrifuge for 5 minutes at 4000 RPM to do biochemical tests. All the biochemical tests were done within few days of blood collection. PSA was measured by immunochemical assays by Chemiluminescence Immunoassay (CLIA) method in Snibe Maglumi 2000 plus, and HbA1C was measured by

a fully automated machine, by Beckman Coulter DxC 700 AU for both diabetic and non-diabetic.

All data were given a case record number, was inserted in Microsoft Excel and finally analyzed using SPSS version 11. Descriptive statistics were expressed as frequencies, percentages, and median with interquartile range (IQR) for continuous variables. The Mann-Whitney U test was used in comparison of nonparametric data. Correlation between two quantitative parameters in the same group was done by using Spearman's correlation.

Results

The participants' baseline features are shown in Table 1. The mean age of the study population was 64.69 ± 10.55 years, with a BMI of 24.67 ± 3.12 kg/m². The median serum PSA level was found to be 1.01 ng/mL (IQR: 0.65,1.76), while the average HbA1C was (5.44 ± 1.31). A comparison of the age distributions of diabetes and non-diabetic groups indicated no statistically significant difference (p = 0.234) (Table 2). Similarly, there were no significant differences in BMI categories between the two groups (p = 0.154) (Table 2). In contrast, PSA levels were considerably less in the diabetes group than in the non-diabetic subjects [0.92 (0.53,1.31) vs. 1.10 (0.73,2.38) ng/mL, p = 0.01] (Table 2).

Table 1: Baseline Characteristics of the Study Participants

Parameters	Values
Age (years)	64.69 ± 10.55
BMI (Kg/m²)	24.67 ± 3.12
PSA (ng/mL)	1.01 (0.65, 1.76)
HbA1C (%)	5.44 ± 1.31

Baseline characteristics represented with mean and median

Table 2: Comparison of Age group, BMI and PSA among Diabetic and Non – Diabetic participants

Category	Diabetic (n = 50)	Non – Diabetic (n = 50)	p – value
Age (years)			0.234
41 – 50	7 (63.6%)	4 (36.4%)	
51 – 60	12 (57.1%)	9 (42.9%)	
61 – 70	21 (53.8%)	18 (46.2%)	
>71	10 (34.5%)	19 (65.5%)	
BMI (Kg/m²)			0.154
Healthy Weight	28 (48.3%)	30 (51.7%)	
Overweight	21 (58.3%)	15 (41.7%)	
Obese	1 (16.7%)	5 (83.3%)	
PSA (ng/ml)	0.92 (0.53, 1.31)	1.1 (0.73, 2.38)	0.01*

Chi – Square Test and Mann Whitney U Test

Correlation studies revealed a somewhat significant relationship between PSA and age (r = 0.31, p = 0.002) (Figure 1). No significant link found between PSA and BMI (r = -0.01, p = 0.34) was observed (Figure 2). Among

diabetics, PSA had a weak negative but non-significant connection with HbA1C in both non – diabetic and diabetic respectively ($r = -0.14$, $p = 0.332$) ($r = -0.140$, $p = 0.332$). (Figure 3 and 4).

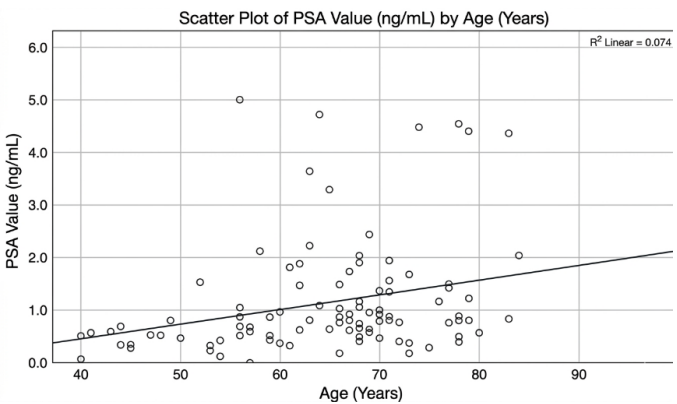


Figure 1: - Scatter Diagram showing positive correlation among PSA and Age group ($r = 0.31$, $p = 0.002$).

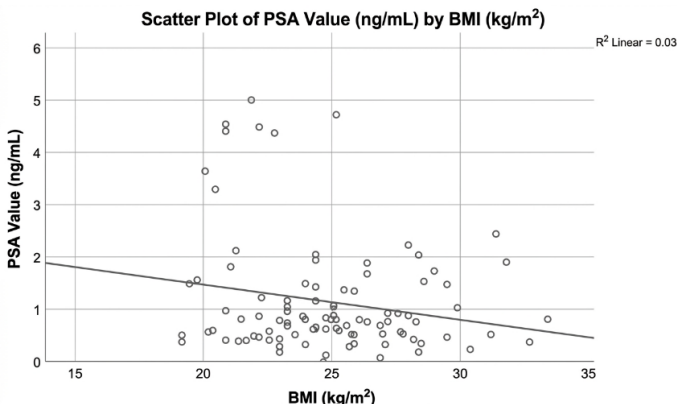


Figure 2: - Scatter diagram showing negative correlation among PSA and BMI ($r = -0.01$, $p = 0.34$).

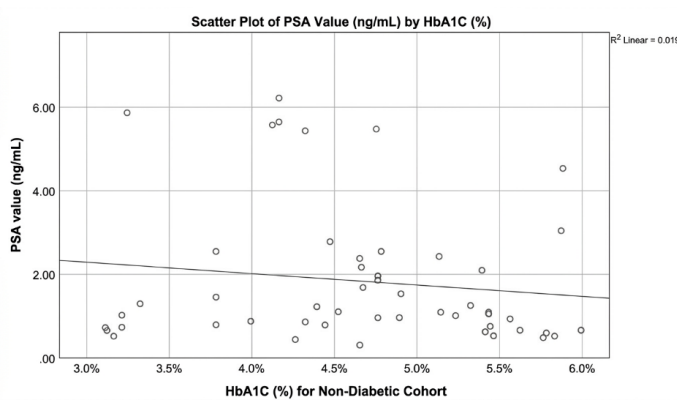


Figure 3: - Scatter diagram showing negative correlation among PSA and HbA1C in Non – Diabetic ($r = -0.14$, $p = 0.332$).

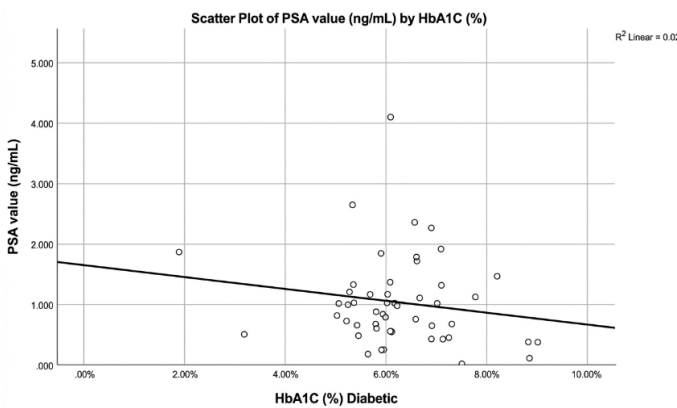


Figure 4: - Scatter diagram showing negative correlation among PSA and HbA1C in Diabetic ($r = -0.140$, $p = 0.332$).

Box-and-whisker plots shows the distribution of PSA across diabetic status, age categories and BMI groups, emphasizing interquartile ranges, medians and outliers (Figures 5, 6 and 7).

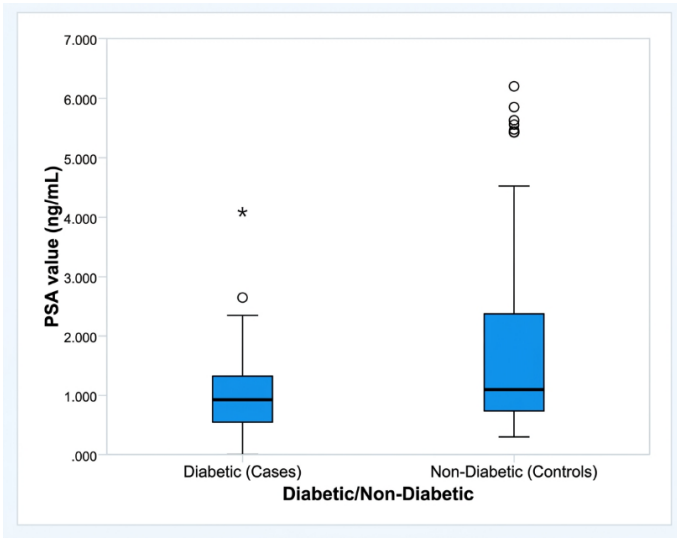


Figure 5: - Illustrates the Whisker box plots showing distribution of PSA within Diabetic and Non – Diabetic.

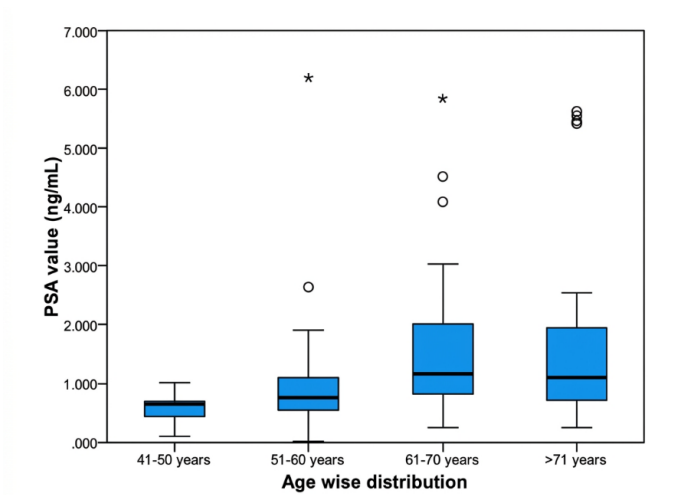


Figure 6: - Illustrates the Whisker box plots showing distribution of PSA within different age group.

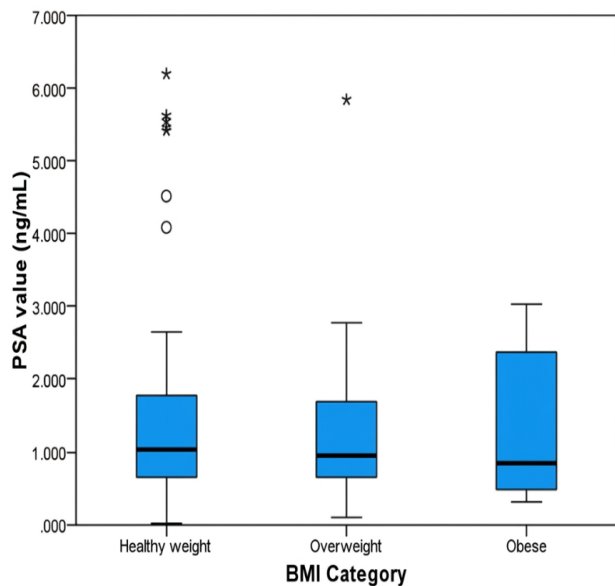


Figure 7: - Illustrates the Whisker box plots showing distribution of PSA with BMI.

Discussion

Prostate-specific antigen (PSA) is a vital marker while evaluating prostate health that is mainly in identifying prostate cancer.⁴ The findings of our study suggest, men with diabetes have significantly lower levels of serum PSA compared to those without diabetes, which also aligns with prior studies suggesting a negative correlation between diabetes and PSA levels.^{4,7} While long-term diabetes has been associated with a reduced risk of prostate cancer, newly diagnosed diabetes might have a different risk.⁷ The biological explanation could involve changes in insulin levels, chronic inflammation and lower androgen levels, all of which can impact the release of PSA from the prostate tissue.⁸ Additionally, long-term high blood sugar levels are linked to reduced IGF-1, which could further lower PSA levels.⁹

Our findings also revealed a positive relationship between age and PSA ($r = 0.31$, $p = 0.002$), consistent with Fukui et al., who noted the highest PSA levels in the 60-70 age group, potentially due to benign prostatic hyperplasia.⁴ In contrast, body mass index (BMI) showed a negative association with PSA ($r = -0.01$), supporting Al-Asadi et al. finding that obesity-related hemodilution and lower testosterone levels might decrease circulating PSA.^{6,9} These results highlight that both demographic and metabolic factors play a role in interpreting PSA levels.

Interestingly, HbA1c, which reflects long-term blood sugar control, was also found to have a negative correlation with PSA ($r = -0.27$) in our study. This supports the idea that poor blood sugar control can worsen insulin resistance, inflammation and androgen activity, thus reducing PSA release.⁴ However, Alhamdan et al. found no such link, possibly due to differences in the population studied.¹⁰

The findings of our study also suggested the median PSA level for diabetic men being 0.92 (0.53,1.31), compared to 1.1 (0.73,2.38) for non-diabetic men ($p = 0.01$), further confirming that diabetes may suppress PSA levels. The evidence from different research supports the hypothesis that diabetes, obesity and poor blood sugar control induce lowered androgen levels, which leads to decreased binding to androgen receptors and lower PSA levels which might explain the reduced incidence of prostate cancer in men with long-term diabetes.^{4,6,11}

Since PSA is a key marker in prostate cancer screening, healthcare professionals should be careful when evaluating PSA levels in patients with metabolic conditions.¹¹ Considering age, BMI and blood sugar levels can improve diagnostic accuracy and aid in making appropriate treatment decisions.^{11,12}

While age, BMI and HbA1c levels were taken into account, other potential confounding factors such as duration of type 2 diabetes, medication use, lifestyle factors and comorbidities were not. These factors may have an impact on PSA levels. Although, this study is a cross-sectional study and contains only data at a particular point in time, which limits the capacity to establish causal correlations but the study also urges to conduct other longitudinal studies to know the variations in PSA levels over time for better understanding of temporal link between diabetes and PSA. This study contributes to the limited data available from Nepal and supports previous findings that suggest to account type 2 diabetes status while evaluating PSA results in screening of the prostate cancer.

Conclusion

Our study indicates that serum PSA levels increase with age in both diabetic and non-diabetic men. However, the rate of increase was reduced in diabetics, suggesting a moderating effect of diabetes on age-related PSA elevation which was consistent with previous observations that metabolic alterations in diabetes influence prostate specific markers like PSA. These findings indicate that diabetes, along with factors such as BMI and glycemic status, may suppress PSA synthesis or secretion through mechanisms involving insulin resistance, hyperinsulinemia and hormonal imbalance. As the findings suggest to account the status of type 2 diabetes while interpreting PSA results in prostate cancer screening, combining metabolic and demographic parameters into screening protocols which may enhance diagnostic accuracy and facilitate timely intervention. Clinicians should therefore interpret PSA levels carefully in men with diabetes, as lower values may uncertain early detection of prostate cancer.

References

1. Atchison EA, Gridley G, Carreon JD, Leitzmann MF, McGlynn KA. Risk of cancer in a large cohort of U.S. Veterans with diabetes. *Int J Cancer* 2011;128:635-43. DOI: [10.1002/ijc.25362](https://doi.org/10.1002/ijc.25362) PMID: 20473855
2. Turner EL, Lane JA, Donovan JL, Davis MJ, Metcalfe C, Neal DE, et al. Association of diabetes mellitus with prostate cancer: Nested case control study (Prostate testing for cancer and treatment study). *Int J Cancer* 2011;128:440-6. DOI: [10.1002/ijc.25360](https://doi.org/10.1002/ijc.25360) PMID: 20473853
3. Diamandis EP. Prostate specific antigen: Its usefulness in clinical medicine. *Trends Endocrinol Metab* 1998;9:310-6. DOI: [10.1016/s1043-2760\(98\)00082-4](https://doi.org/10.1016/s1043-2760(98)00082-4) PMID: 18406295
4. Fukui M, Tanaka M, Kadono M, Imai S, Hasegawa G, Yoshikawa T, Nakamura N. Serum prostate-specific antigen levels in men with type 2 diabetes. *Diabetes Care*, 2008; 31: 930-931. DOI: [10.2337/dc07-1962](https://doi.org/10.2337/dc07-1962) PMID: 18276768
5. Onitilo AA, Stankowski RV, Berg RL, Engel JM, Glurich I, Williams GM, Doi SA. Type 2 diabetes mellitus, glycemic control, and cancer risk. *Eur J Cancer Prev*. 2014 Mar;23(2):134-40. DOI: [10.1097/CEJ.0b013e3283656394](https://doi.org/10.1097/CEJ.0b013e3283656394) PMID: 23962874
6. Al-Asadi JN, Al-Naama LM, Abdul-Kareem MM, Mashkoor FC. Serum level of prostate-specific antigen in diabetic patients in Basrah, Iraq. *Niger Postgrad Med J*. 2017 Oct-Dec;24(4):240-244. DOI: [10.4103/npmj.npmj_174_17](https://doi.org/10.4103/npmj.npmj_174_17) PMID: 29355164
7. Liu X, Hemminki K, Försti A, Sundquist K, Sundquist J, Ji J, et al. Cancer risk in patients with type 2 diabetes mellitus and their relatives. *Int J Cancer* 2015;137:903-10. DOI: [10.1002/ijc.29440](https://doi.org/10.1002/ijc.29440) PMID: 25604005
8. Giovannucci E, Harlan DM, Archer MC, Bergenstal RM, Gapstur SM, Habel LA, Pollak M, Regensteiner JG, Yee D. Diabetes and cancer: a consensus report. *Diabetes Care* 2010;33:1674- 85. DOI: [10.2337/dc10-0666](https://doi.org/10.2337/dc10-0666) PMID: 20587728
9. Bharti A, Shekhar R, Prakash P, Kumari S, Kumar S. Poor Glycemic Control Affecting Screening of Prostate Carcinoma. *Cureus*. 2024 Apr 21;16(4):e58680. DOI: [10.7759/cureus.58680](https://doi.org/10.7759/cureus.58680) PMID: 38774165
10. Alhamdan WA, Alsulaiman TA, Alsabti RI, Abdulmowla OM, Elnaggar SE, Alendijani Y. Association between body mass index and hemoglobin A1c with serum prostate-specific antigen level: A retrospective cohort study. *Saudi Med J*. 2023 Sep;44(9):870-874. DOI: [10.15537/smj.2023.44.9.20230384](https://doi.org/10.15537/smj.2023.44.9.20230384) PMID: 37717968
11. Han JH, Choi NY, Bang SH, Kwon OJ, Jin YW, Myung SC, Chang IH, Kim TH, Ahn SH. Relationship between serum prostate-specific antigen levels and components of metabolic syndrome in healthy men. *Urology*. 2008 Oct;72(4):749-54; discussion 754-5. DOI: [10.1016/j.urology.2008.01.084](https://doi.org/10.1016/j.urology.2008.01.084) PMID: 18701153
12. Kobayashi M, Mizuno T, Yuki H, Kambara T, Betsunoh H, Nukui A, Abe H, Fukabori Y, Yashi M, Kamai T. Association between serum prostate-specific antigen level and diabetes, obesity, hypertension, and the laboratory parameters related to glucose tolerance, hepatic function, and lipid profile: implications for modification of prostate-specific antigen threshold. *Int J Clin Oncol*. 2020 Mar;25(3):472-478. DOI: [10.1007/s10147-019-01527-6](https://doi.org/10.1007/s10147-019-01527-6) PMID: 31440861