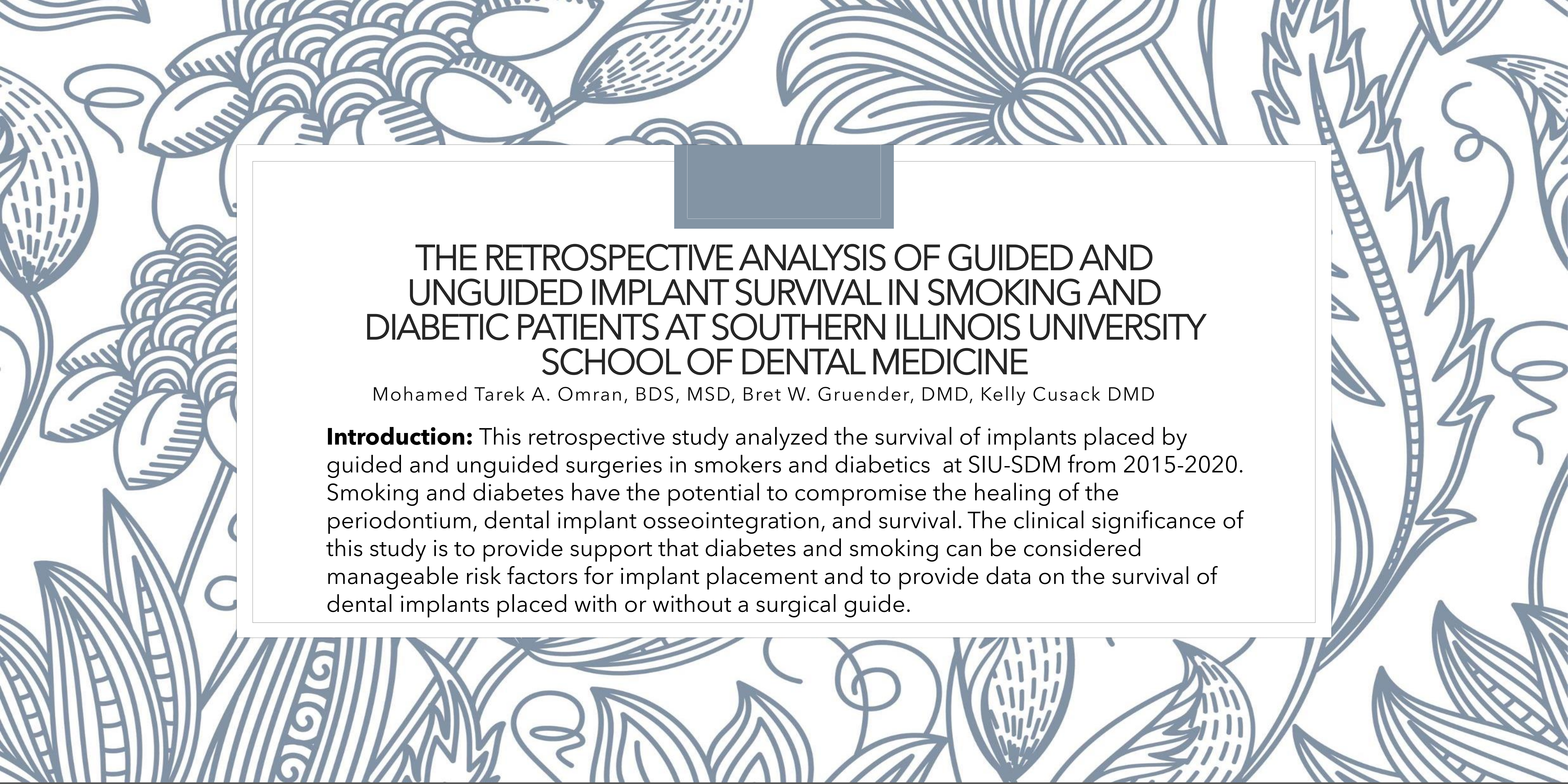




THE RETROSPECTIVE ANALYSIS OF GUIDED AND UNGUIDED IMPLANT SURVIVAL IN SMOKING AND DIABETIC PATIENTS AT SOUTHERN ILLINOIS UNIVERSITY SCHOOL OF DENTAL MEDICINE

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Introduction: This retrospective study analyzed the survival of implants placed by guided and unguided surgeries in smokers and diabetics at SIU-SDM from 2015-2020. Smoking and diabetes have the potential to compromise the healing of the periodontium, dental implant osseointegration, and survival. The clinical significance of this study is to provide support that diabetes and smoking can be considered manageable risk factors for implant placement and to provide data on the survival of dental implants placed with or without a surgical guide.

Materials and Methods

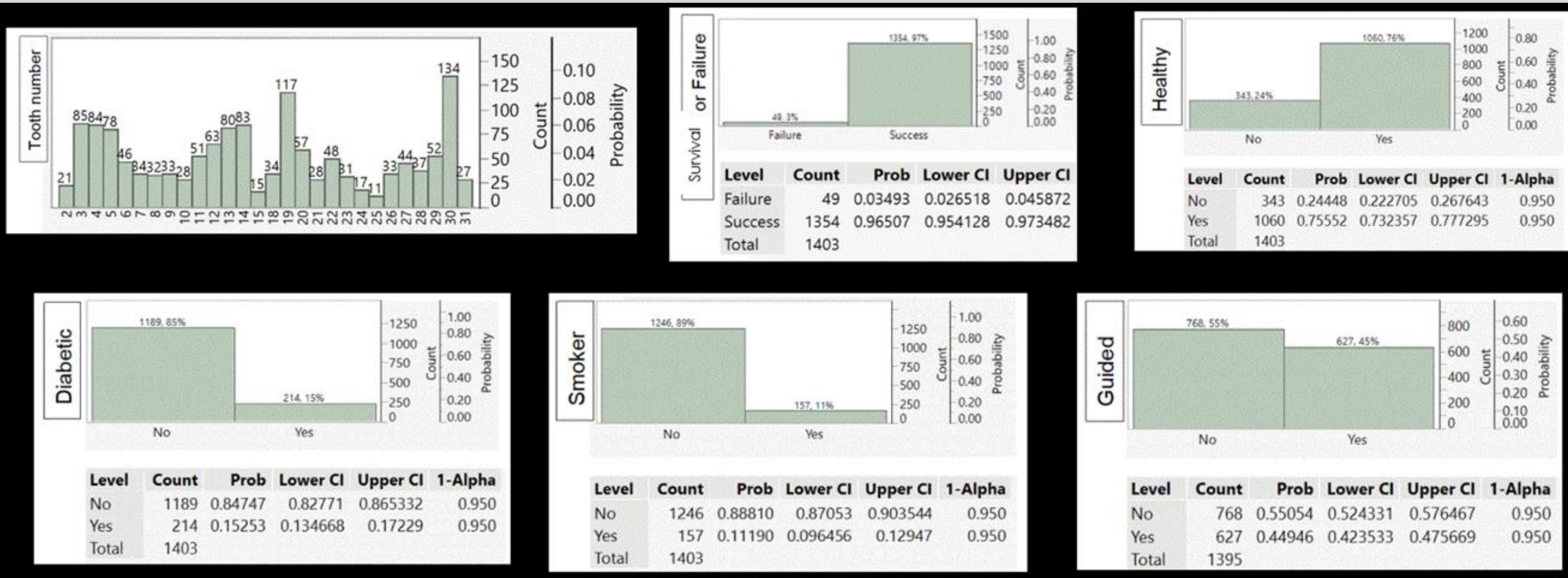
- SIU SDM implant patients from 2015 -2020. Cases were classified based on success / failure, smoker, diabetic, and surgical guides
- **Inclusion Criteria** - 18 years or older, the implant must achieve a minimum insertion torque of 35 N/cm., enough available bone for implant placement, received at least one implant
- **Exclusion Criteria** - irradiated bone, immuno-compromising or other severe systemic diseases, intravenous bisphosphonate treatment, and severe periodontal disease
- **Failed implant** - implant that has been surgically removed after placement due to failure to osseointegrate.
- **Surviving Implant** - implant that has been placed and is currently in the patient's mouth
- **Healthy** - not diabetic and did not smoke.
- **Surgical Guides** - are printed and designed using implant planning software and Dicom data from CBCT and STL data from the patient's dental models

Groups	Total	Failure	Survival
Healthy and Guided	472	17	455
Healthy and Unguided	584	19	565
Smoker and Guided	74	0	74
Smoker and Unguided	53	1	52
Diabetic and Guided	68	3	65
Diabetic and Unguided	118	5	113
Smoker, Diabetic, Guided	15	4	11
Smoker, Diabetic, Unguided	11	0	11

Data Analysis and Results

Phase 1

- Prediction Equations
- Analyzed variables that may predict the outcome (failure or survival) = implant position, healthy, diabetic, smoker, guided, survival or failure counts and probabilities for each category



Phase 2

- o Contingency Tables
- o created for the following variables: implant position, healthy, diabetic, smoker, guided - assessed the null hypothesis of no difference on predicting the outcome (survival or failure)
- o likelihood ratio, chi-squared test, and Fisher's exact test
- o All 5 failed to reject the null hypothesis!
- o Not able to identify any variable that appeared to predict the outcome (failure or survival)

Implant Position

Total	49	1354	1403
	3.49	96.51	

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	31.111	0.2666
Pearson	32.389	0.2180
Fisher's Exact 2-Tailed test	P =	0.3073

	Count	Failure	Survival	Total
	Total %			
	Col %			
	Row %			
Healthy	No	13	330	343
		0.93	23.52	24.45
		26.53	24.37	
		3.79	96.21	
Yes		36	1024	1060
		2.57	72.99	75.55
		73.47	75.63	
		3.40	96.60	
Total	49	1354	1403	
	3.49	96.51		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.117	0.7321
Pearson	0.119	0.7298
Fisher' Exact 2-Tailed test	P =	0.7358

Healthy

	Count	Failure	Survival	Total
	Total %			
	Col %			
	Row %			
Diabetic	No	37	1152	1189
		2.64	82.11	84.75
		75.51	85.08	
		3.11	96.89	
Yes		12	202	214
		0.86	14.40	15.25
		24.49	14.92	
		5.61	94.39	
Total	49	1354	1403	
	3.49	96.51		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.941	0.0863
Pearson	3.351	0.0672
Fisher' Exact 2-Tailed test	P =	0.1018

Diabetic

	Count	Failure	Survival	Total
	Total %			
	Col %			
	Row %			
Smoker	No	44	1202	1246
		3.14	85.67	88.81
		89.80	88.77	
		3.53	96.47	
Yes		5	152	157
		0.36	10.83	11.19
		10.20	11.23	
		3.18	96.82	
Total	49	1354	1403	
	3.49	96.51		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.051	0.8214
Pearson	0.050	0.8236
Fisher' Exact 2-Tailed test	P =	1.0000

Smoker

	Count	Failure	Survival	Total
	Total %			
	Col %			
	Row %			
Guided	No	25	743	768
		1.79	53.26	55.05
		51.02	55.20	
		3.26	96.74	
Yes		24	603	627
		1.72	43.23	44.95
		48.98	44.80	
		3.83	96.17	
Total	49	1346	1395	
	3.51	96.49		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.332	0.5642
Pearson	0.334	0.5634
Fisher' Exact 2-Tailed test	P =	0.5630

Guided

Data Analysis and Results

◦ Phase 3

- Used phase 2 data for statistical model building
 - A. Classification Tree Analysis → all cases as survivals
 - B. Neural Nets to create several models → all cases as survivals
 - C. Stepwise logistic regression analyses - full factorial interactions and two-factorial interactions → all cases as survivals
- If a dentist were to use any of these models to predict survival or failure of an implant to be placed in a patient, despite clinical characteristics, the model would always predict 100% probability of survival

◦ Phase 4

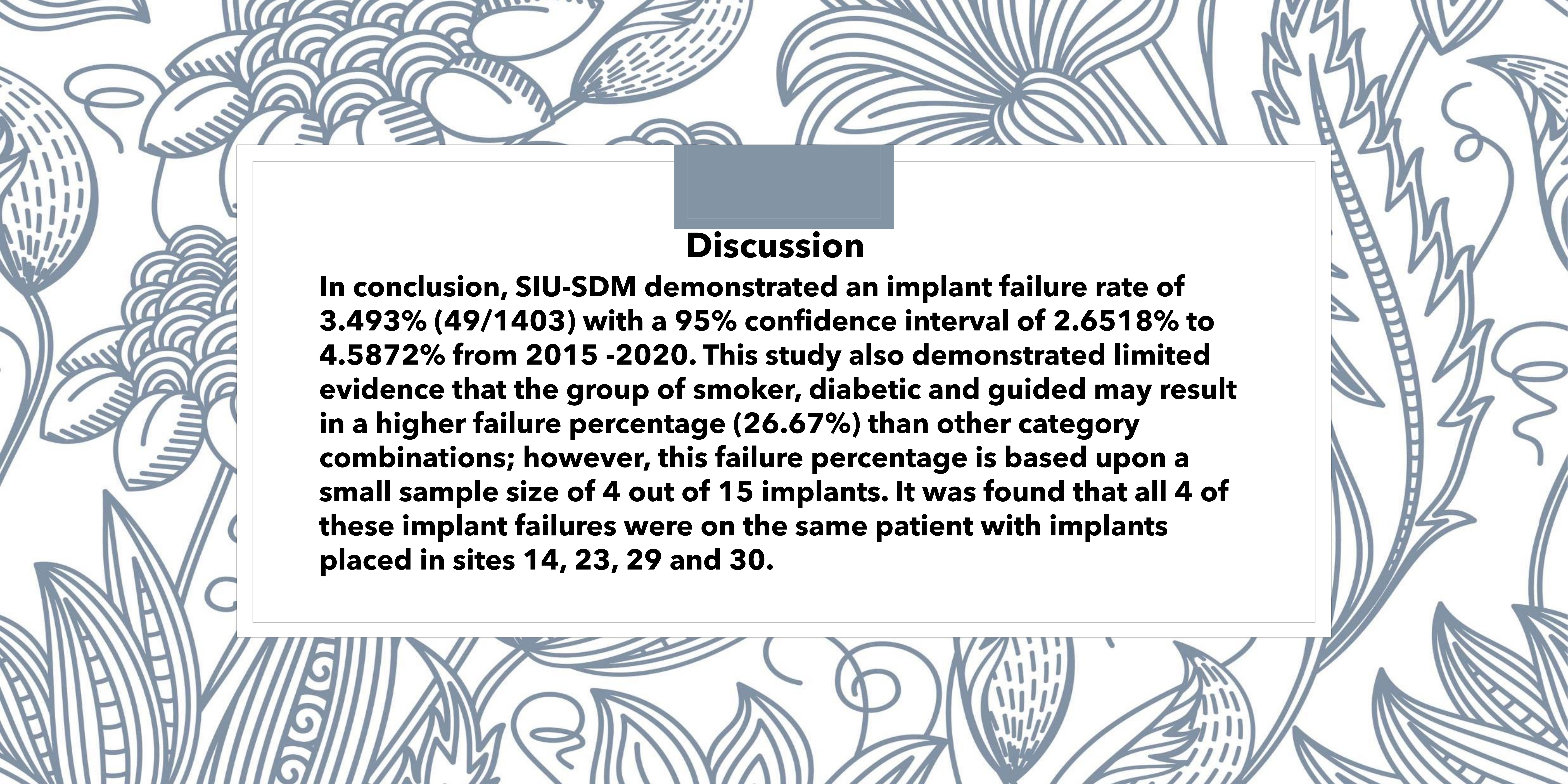
- Contingency table of each group versus failure or survival - we assessed the null hypotheses of no difference on predicting the outcome (survival or failure)
- likelihood ratio, Pearson chi-square tests, and Fisher's exact test.
- The largest Cell Chi2 is 22.894 = Failure versus Smoker_Diabetic_Guided

◦ Phase 5

- Fisher's exact test of Survival or Failure counts for Smoker_Diabetic_Guided versus Survival and Failure count totals for all other categories, with the result rejecting the null hypothesis ($P = 0.00138$)
- Generalized regression analysis - with Failure or Survival as the outcome variable, and with all categories as the predictors → all cases were classified as survivals

Count	Failure	Survival	Total
Total %			
Col %			
Row %			
Expected			
Deviation			
Cell Chi^2			
Diabetic_Guided	3	64	67
	0.22	4.59	4.80
	6.12	4.75	
	4.48	95.52	
	2.35341	64.6466	
	0.64659	-0.6466	
	0.1777	0.0065	
Diabetic_Unguided	5	113	118
	0.36	8.10	8.46
	10.20	8.40	
	4.24	95.76	
	4.1448	113.855	
	0.8552	-0.8552	
	0.1765	0.0064	
Healthy_Guided	17	455	472
	1.22	32.62	33.84
	34.69	33.80	
	3.60	96.40	
	16.5792	455.421	
	0.42079	-0.4208	
	0.0107	0.0004	
Healthy_Unguided	19	565	584
	1.36	40.50	41.86
	38.78	41.98	
	3.25	96.75	
	20.5133	563.487	
	-1.5133	1.51326	
	0.1116	0.0041	

Smoker_Diabetic_Guided	4	11	15
	0.29	0.79	1.08
	8.16	0.82	
	26.67	73.33	
	0.52688	14.4731	
	3.47312	-3.4731	
	22.8942	0.8334	
Smoker_Diabetic_Unguided	0	11	11
	0.00	0.79	0.79
	0.00	0.82	
	0.00	100.00	
	0.38638	10.6136	
	-0.3864	0.38638	
	0.3864	0.0141	
Smoker_Guided	0	74	74
	0.00	5.30	5.30
	0.00	5.50	
	0.00	100.00	
	2.59928	71.4007	
	-2.5993	2.59928	
	2.5993	0.0946	
Smoker_Unguided	1	52	53
	0.07	3.73	3.80
	2.04	3.86	
	1.89	98.11	
	1.86165	51.1384	
	-0.8616	0.86165	
	0.3988	0.0145	



Discussion

In conclusion, SIU-SDM demonstrated an implant failure rate of 3.493% (49/1403) with a 95% confidence interval of 2.6518% to 4.5872% from 2015 -2020. This study also demonstrated limited evidence that the group of smoker, diabetic and guided may result in a higher failure percentage (26.67%) than other category combinations; however, this failure percentage is based upon a small sample size of 4 out of 15 implants. It was found that all 4 of these implant failures were on the same patient with implants placed in sites 14, 23, 29 and 30.