Pellagra at the Mississippi State Asylum: An examination of differential survivorship

MICHELLE L. DAVENPORT[1], NICHOLAS P. HERRMANN[2], MOLLY K. ZUCKERMAN[1], and MICHAEL MURPHY[3]
[1]Department of Anthropology and Middle Eastern Cultures, Mississippi State University, [2]Department of Anthropology, Texas State University, [3]Department of History, Mississippi State University

Introduction

Pellagra—a nutritional disease characterized by niacin and tryptophan deficiency—is associated with poverty, social marginalization, and corn-heavy diets. Its symptoms include, in no particular order, diarrhea, dementia, dermatitis, and lastly, death [1]. Historical evidence indicates that it was endemic in the American South between approximately 1902 and 1945 [2,3,4]. In particular, pellagra profoundly impacted the health and mortality of institutionalized populations, with dementia commonly leading to institutionalization [5], and inadequate diets leading to development of the disease during institutionalization [2,4].

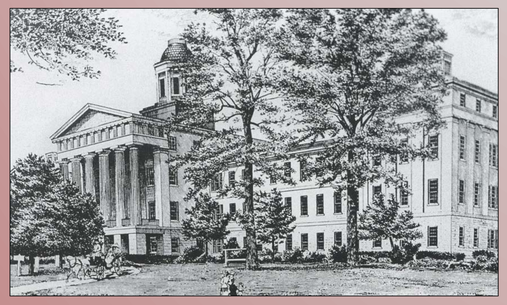


Figure 1: The Mississippi State Asylum, Jackson, MS, est. 1855
http://msacp.cobb.msstate.edu/History_Image%201.html

This research assesses pellagra survivorship in the Mississippi State Asylum (MSA) between 1909 and 1936 to gain a better understanding of pellagra's impact on the patient population. The MSA, which housed 35,000 total patients between 1855 and 1935, was located in Jackson, MS; its patient records indicate that pellagra was a significant cause of death during the study period [Table 1,Table 2].

Table 1: Pellagra mortality in the MSA (1909-1936)

Demographic Group	Pellagra Mortality	%
Females	544	65.23
Males	290	34.73
'Colored'	726	87.05
'White'	108	12.95
TOTAL	834	100

Table 2: Pellagra, tuberculosis, and syphilis mortality in the MSA (1909-1936)

Sex	Socially Defined Race	Total Deaths	% of Total	Pellagra Deaths	Pellagra % of Total	TB Deaths	TB % of Total	Syphilis Deaths	Syph. % of Total
F	C	1275	36.14	479	37.57	150	11.76	11	0.86
F	W	461	13.07	65	14.10	38	8.24	0	0.00
Total F		**1736**	**49.21**	**544**	**31.33**	**188**	**10.83**	**11**	**0.86**
M	C	1274	36.11	247	19.39	112	8.79	24	1.88
M	W	518	14.68	43	8.30	44	8.49	2	0.39
Total M		**1792**	**50.79**	**290**	**16.18**	**156**	**8.71**	**26**	**1.45**
Grand Total		**3528**	**100.00**	**834**	**23.64**	**344**	**9.75**	**37**	**1.05**

Hypothesis 1: Pellagra survivorship will be different than survivorship of causes of death that are not pellagra.
Hypothesis 2: Differential pellagra survivorship occurs between sexes (male and female) and socially defined races listed in the admission and death records ('white' and 'colored').
Hypothesis 3: There are differences in pellagra survivorship within demographic groups (male, female, 'colored', 'white') over the course of the study period.

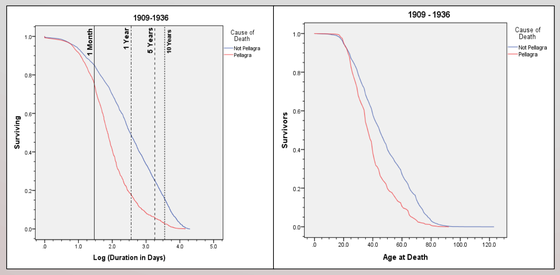
Materials and Methods

MSA admissions and death by discharge records for the study period were transcribed. Year of death, age at death, sex, social race, cause of death, and total duration in the asylum were queried for each patient. Kaplan-Meier survivorship curves and test statistics were plotted in SPSS against duration in the asylum and age at death. A parametric hazard model was run to compare risk ratios for sex, race, and cohort by age and duration; the hazard model verifies the Kaplan-Meier survivorship results.

Results

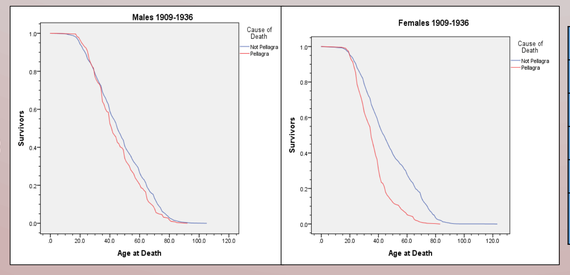
Hypothesis 1:
Survivorship curves were plotted to compare pellagra and not pellagra survivorship for sex and social race.

a)



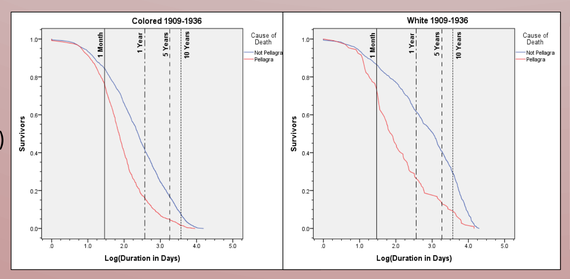
Log Duration		
	ALL	
	X^2	p
Log Rank	385.599	**0.000**
Breslow	347.423	**0.000**
Tarone-Ware	383.824	**0.000**
Age		
Log Rank	165.222	**0.000**
Breslow	132.691	**0.000**
Tarone-Ware	154.623	**0.000**

b)



Age				
	Male		Female	
	X^2	p	X^2	p
Log Rank	6.91	**0.009**	204	**0.000**
Breslow	4.002	**0.045**	147	**0.000**
Tarone-Ware	5.561	**0.018**	176	**0.000**

c)



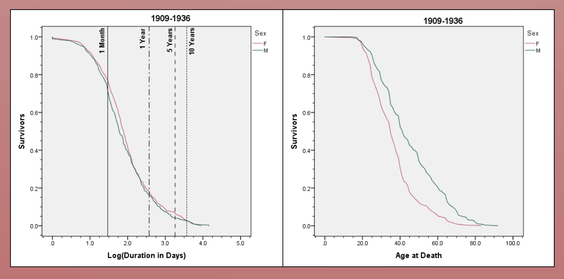
Duration				
	Colored		White	
	X^2	p	X^2	p
Log Rank	203.44	**0.000**	33.408	**0.000**
Breslow	183.03	**0.000**	40.685	**0.000**
Tarone-Ware	204.86	**0.000**	40.247	**0.000**

Figures 3a-3c: Pellagra versus not pellagra survivorship curves and test statistics for the MSA by a) the total patient population, b) sex, and c) social race.

Pellagra survivorship is significantly different ($p<0.05$) in all cases for both duration and age compared to all other causes of death. Results **support** Hypothesis 1.

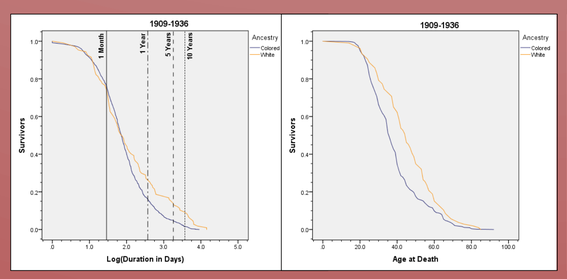
Hypothesis 2:
Survivorship curves were plotted to compare pellagra survivorship between sexes and social races. Results were varied.

a)



Log Duration		
	ALL	
	X^2	p
Log Rank	0.817	0.366
Breslow	2.098	0.147
Tarone-Ware	1.653	0.199
Age		
Log Rank	64.897	**0.000**
Breslow	47.606	**0.000**
Tarone-Ware	57.55	**0.000**

b)



Log Duration		
	ALL	
	X^2	p
Log Rank	9.883	**0.002**
Breslow	0.851	0.356
Tarone-Ware	3.279	0.070
Age		
Log Rank	14.964	**0.000**
Breslow	19.124	**0.000**
Tarone-Ware	18.991	**0.000**

Figure 4a-4b: Comparative pellagra survivorship curves and test statistics for the MSA by a) sex, and b) social race.

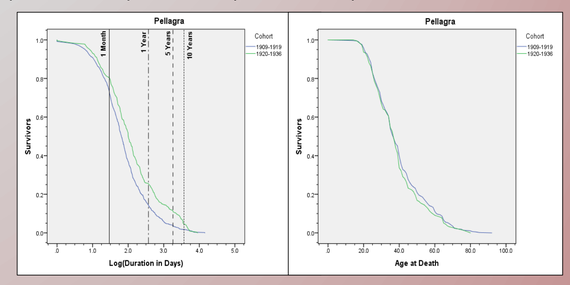
All curves comparing pellagra survivorship indicate significant differences by age ($p<0.05$), but not by duration ($p>0.05$). Results **support** Hypothesis 2 for age, but **reject** it for duration.

Acknowledgements: Amber Plemons

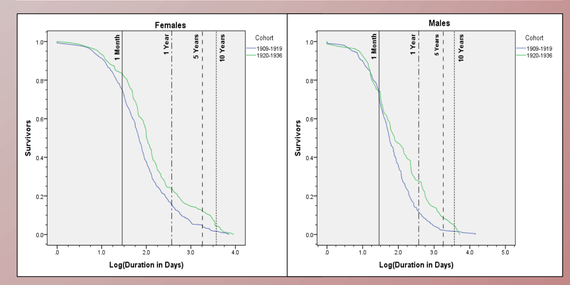
References
1. Rajakumar K. 2000. Pellagra in the United States: a historical perspective. Southern medical journal 93:272–277.
2. Goldberger, J. 1914. The Etiology of Pellagra. Public Health Reports 29(26): 373-375.
3. Goldberger J, Waring CH, and Tanner WF. 1923. Pellagra Prevention by Diet among Institutional Inmates. Public Health Reports 38(41):2361-2368.
4. Searcy G. 1907. An Epidemic of Acute Pellagra. Journal of the American Medical Association 49(1):37-38.
5. Stockman R, and Johnson JM. 1933. Cereal Food Poisoning and its relation to the Etiology of Pellagra. Journal of Hygiene 33(2).
6. Brenton BP. 2000. Pellagra, Sex, and Gender: Biocultural Perspectives on Differential Diets and Health.
7. Superintendent, 1929. 37th Biennial Report of the Superintendent of the Mississippi State Asylum (1927-1929). Housed at the Mississippi Department of Archives and History.

Hypothesis 3:
Survivorship curves were plotted for sex and social race separated into early (1909-1919) and late (1920-1936) cohorts. Results varied.

a)



b)



Log Duration						
	ALL		Male		Female	
	X^2	p	X^2	p	X^2	p
Log Rank	17.115	**0.000**	6.657	**0.010**	12.197	**0.000**
Breslow	14.257	**0.000**	4.079	**0.043**	10.279	**0.001**
Tarone-Ware	17.09	**0.000**	3.01	**0.014**	11.382	**0.001**
Age						
Log Rank	1.112	0.292	1.837	0.175	0.051	0.882
Breslow	0.682	0.409	2.168	0.141	**0.006**	0.936
Tarone-Ware	0.884	0.347	1.993	0.158	**0.008**	0.930

Figures 6a-6b: Pellagra survivorship curves and test statistics for Cohort 1 versus Cohort 2 in the MSA during the study period by a) total patient population, b) sex.

Pellagra survivorship is not significantly different between cohorts by age ($p>0.05$), but is significantly different by duration ($p<0.05$). Results **support** Hypothesis 3 for duration, but **reject** it for age.

*Cohort comparisons may be subject to biases due to the late cohort's small sample size. More records from between 1920 and 1936 need to be transcribed for accurate survivorship comparisons.

Summary and Conclusion

Pellagra survivorship in the MSA is different than survivorship from other causes of death, and is different between sexes and social races. These disparities may be due to pre-admittance pellagra rates compounded by poor conditions within the asylum. Female and colored patients experience a greater decline in survivorship earlier than male and white patients, respectively, which may be due to their elevated risk of developing pellagra outside the asylum. Females in the early 20th century South were noted to be at higher risk for pellagra because of heightened estrogen production and their role in the home, influencing when and what they ate [6]. Social prejudice resulted in marginalization of the 'colored' population during this time, limiting access to high quality protein, and producing low quality diets dependent on corn. 'Colored' patients were noted in biennial reports from the MSA Superintendent as being subject to much poorer living and dietary conditions than were their white counterparts, resulting in heightened mortality rates [7].

Biodemographic and paleopathological analyses of associated skeletal remains, such as the skeletal sample from the MSA, can be compared to survivorship analyses to assess differences between direct and indirect evidence of institutional mortality and to, potentially, identify physical indicators of specific diseases, such as pellagra. The use of skeletal data and discharge records enhances the ability for researchers to address questions concerning health.

This study demonstrates that survivorship analysis allows researchers to demonstrate that, while health within institutions during this period was poor, there is variation in disease mortality related to heterogeneous risk originating in social inequalities outside of the asylum which influence conditions, and consequently survivorship, within the asylum. Results of this study can be compared to findings from other institutions to improve our limited understanding of the health and demography of institutionalized populations by investigating differential survivorship.