**Implementing By-Name Databases to Resolve Homelessness in Charlottesville Virginia**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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# Implementing By-Name Databases to Resolve Homelessness in Charlottesville Virginia

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## Abstract

Over five hundred thousand people experience homelessness in America, and with problems, such as income inequality and gentrification, this population is set to increase (National Academies, 2018). A part of the issue is the lack of information American communities have on their homelessness issue. To address this, communities could implement the By-Name Database, that is a database where information on a person's homelessness can be looked up by name. Techniques from CS 4750 could be used to implement the By-Name database. However, other more advance techniques would be needed to make the By-Name database reach its full potential.

## 1. Introduction

A part of America's problem in addressing homelessness is the lack of information on homeless populations. The US Department of Housing and Urban Development (HUD) mandates that cities do an annual point in time census. The census alone is inadequate information for a community to address homelessness as it gives little information on the causes, and so the community is unable to make an informed decision on where to shift resources (Community Solutions, 2018, pg. 9). Haggerty proposes that communities adopt By-Name databases, that is databases where all relevant information on a person experiencing homelessness can be looked up by name.

In order for this database to be effective it needs to have several qualities. First, it needs to be accessible to all groups within the local community who touch upon homelessness – housing authorities, shelters, hospitals, police, welfare offices, foster homes, etc. Second, it needs to contain any relevant information that may help resolve a person's homelessness. This includes medical information, information on mental illness, incarceration history, substance abuse history, what programs the person is enrolled in, and information on familial relationships. Homelessness is complicated and caused by interrelated factors. Thus, to find trends on a broader, community level, the community needs nuanced information.

A concrete example of the By-Name database at work is that of Lake County, Illinois, where Community Solutions implemented a By-Name database that helped eliminate veteran homelessness in the area. Ranney (2021) describes how as the community looked at the By-Name database, they discovered that "many veterans experiencing homelessness were staying at the local VA medical center's domiciliary care, which provided medical rehabilitation and treatment, for extended periods of time. The team soon realized that many of those individuals were not moving into permanent housing because they needed to live at the domiciliary to access dental care." (p. 6) Lake

County was able to create other avenues for the veterans to receive dental care, and this caused veterans to start moving to more permanent housing. There is always an explanation for homelessness, and often it is one that is unintuitive. Having a By-Name database allows for a community to untangle and find the root causes.

The technical requirements for the By-Name database include that it must be accessible to many parties. It also must be able to contain any information that would be useful in assessing a community's homelessness situation. This includes having the ability to let an administrator add attributes to the database. Furthermore, the database must be secure. The unhoused population will likely be wary of adding their personal information to a database. Their history likely predisposes them to distrust authority. A first essential step to garnering their trust is making the database secure.

## 2. Related Works

Community Solutions. "Getting To Proof Points." *Https://Community.solutions*, Mar. 2018, Accessed 4 Oct. 2021.

Community Solutions is a non-profit dedicated to eliminating homelessness in communities. Their overarching philosophy is to organize the response to homelessness such that the community is "Built For Zero"; that is that all the actors within the community are dedicated to preventing chronic homelessness. The method that they argue for that interests me most is the idea of a By-Name Database. The United States Department of Housing and Urban Development (HUD) mandates a point-in-time census of the homeless population. Once a year HUD mandates cities to count the number of people experiencing homelessness within the community. Community Solutions points out that this is inadequate information to address homelessness. With a point-in-time census there is virtually no actionable data. The city does not know how much of that population is homeless due to drug addiction or mental illness or familial problems, etc. Community Solutions proposes a By-Name database. This means every person experiencing homelessness has an entry in a centralized database that can be accessed by all the organizations that touch upon homelessness. This allows the community to better address the problems within the population and to measure whether the homeless population is actually decreasing.

United States Interagency Council on Homelessness, "The Importance of Housing Affordability and Stability for Preventing and Ending Homelessness." May 2019.

This is a report from the United States Interagency Council on Homelessness. The report consists of an explanation on the link between housing affordability and homelessness. It explains how over the last forty years housing prices have greatly increased while wages have remained stagnant. Today, HUD estimates that more than eight million households with very low incomes pay more than fifty percent of their household income for housing. Furthermore, the National Low Income Housing Coalition estimates that there is a shortage of 7 million rental homes for households whose incomes are less than 30% of the median income in their community.

Koegel, P., Burnam, M. A., & Baumohl, J. (2001). The causes of homelessness: an integrated perspective. *Church & Society*, *91*(5), 41–47.

This article provides a broad overview of the causes of homelessness. It explains two modes of explanation on the cause of homelessness: 1) it is due to individual factors, such as mental illness or

drug addiction, and 2) it is due to structural factors. The article concludes that it is a complicated combination of both. Some of the structural factors the article outlines include the wide deinitialization in the 70's (psychiatric wards became underfunded in the 70's causing a large swath of mentally ill people to become homeless); a decrease in the creation of low income housing over time; and increasing property values and stagnant wages pricing people out of the market. On the other hand, the article notes that 25% of people experiencing homelessness have some form of mental illness, half of them experienced a significant loss of income in the year before becoming homeless, and more than two fifths say they recently went through interpersonal relationship strife.

Ranney, Kaitilyn. "Lake County, Illinois: Veteran Functional Zero Case Study." *Https://Community.solutions*, 27 Jan. 2021, https://community.solutions/case-studies/lake-county-illinois-functional-zero-case-study/. Accessed 4 Oct. 2021.

This article is a case study of the effect of the Community Solutions By-Name database method on the community of Lake County, Illinois. Lake County was able to follow the guidelines set out by Community Solutions in their "Getting To Proof Points" article and as a result effectively eliminated Veteran Homelessness. All of Lake County's actors who addressed homelessness—the housing authority, non-profits, hospitals, the police department—were talking to one another. They all had access to a centralized By-Name database. The article provides a concrete example of an instance in which the community benefited from the By-name database. "As they looked at their data, the team also discovered that many veterans experiencing homelessness were staying at the local VA medical center's domiciliary care, which provided medical rehabilitation and treatment, for extended periods of time. The team soon realized that many of those individuals were not moving into permanent housing because they needed to live at the domiciliary to access dental care."

## 3. Methods

CS 4750 Databases taught how to structure a database, Relational Algebra, database security, and how to implement a database with SQL. All of the concepts from CS 4750 can be used to implement the By-Name database. This includes the language of SQL as SQL is a commonly used database management language. The schema for the By-Name database might look like this.

**Fig. 1 Sample By-Name Database Schema**

| id | first_name | last_name | date_of_birth | city_of_origin | annual_income | med_history | vet_status |
|---|---|---|---|---|---|---|---|
| granh | Grant | Hester | 12/1/1965 | Tallahassee, FA | 10,000 | PTSD | yes |
| rebel | Rebecca | Long | 7/24/1987 | Charlottesville, VA | 5,000 | n/a | no |
| sarat | Sarah | Trenton | 4/15/1953 | Washington DC | 0 | Blind | no |
| kennh | Kenny | Hartford | 8/11/1972 | Atlanta, GA | 12,000 | n/a | no |

Other attributes that would be in this database include health insurance information, substance abuse history, current case manager for various social service organizations, incarceration history, and information on familial relationships. With SQL other attributes could be easily added by the administrator as the need arises. Also note from the sample schema the column ID. This would be an essential column, because every valid database requires a primary key—a unique identifier for each entry in the database. With this schema, we could easily access a powerful, flexible amount of information regarding the unhoused population.

**Fig. 2 Sample SQL Commands**

```
SELECT  *  FROM  by_name  WHERE
first_name="Kenny",
last_name="HARTFORD"  //  get
all  information  for  Kenny
Hartford
SELECT vet_status FROM by_name
//access  whole  vet_status
column
```

Because the By-Name database would contain extremely sensitive information on the unhoused people, it would be essential for it to be secure. The security methods from CS 4750 include salting and hashing passwords and using prepared statements to prevent SQL injections. To login to the By-Name database we would need to have a database of usernames and passwords. By salting and hashing the passwords within this database we are encrypting the passwords so that they cannot be easily read by intruders as they would be if they were plaintext. SQL injections refer to instances when intruders insert commands into the user interface (usually the login). If a software engineer does not take the necessary precautions, an intruder can use the login screen to do disastrous damage, such as accessing all of the database information or deleting the whole table. To prevent this it is industry practice to use prepared statements, such as this in PHP. A similar prepared statement was used in the final project for CS 4750 and would likely be used if we were to employ the concepts from CS 4750 to implement a By-Name database.

**Fig. 3 - Example of Prepared Statement to Prevent SQL Injection**



```
PHP
SELECT Statement
$stmt = $db->prepare('SELECT * FROM users where name = ? where id = ?');
$stmt->bind_param('si', $name, $id);
$stmt->execute();
```

From hackedu.com

## 4. Results

With the CS 4750 techniques outlined in the methods section we could implement a bare bones By-Name database. This would assist in allowing the community to have continuous information about their homelessness problem and so better allow them to address it. The implementation outlined in this report is of course bare-bones. If this database were to be implemented in real life, we would likely need to take more security precautions. Furthermore, we could expand the schema to include objects to contain information on the unhoused person's case handler and doctors.

## 5. Conclusion

Homelessness is a serious problem in America, and as income inequality and housing prices continue to rise, it will get worse. America needs to use everything at its disposal to combat this problem that is an affront to human dignity, and technology might be the greatest tool society has. In this paper I have outlined ways in which the principles from an undergraduate Computer Science database class can be applied to the homelessness problem in the form of the By-Name database. Even with the rudimentary concepts and techniques found in this undergraduate class, it is possible to design a simple By-Name database that if properly implemented would be a useful tool in the fight against homelessness.

## 6. Future Work

This paper simply outlined how database technology could be used to fight homelessness. The real work would be creating the By-Name database. Furthermore, even a perfectly working technological solution may not be effective in the actual world. It needs to be properly integrated into the organizations that fight homelessness—welfare institutions, housing organizations, non-profits, hospitals, etc. In addition, the

By-Name database requires cooperation among the unhoused themselves, who would have to volunteer their personal information in order for the system to work. Such issues should be thoroughly explored in future research.

**References**

Community Solutions. "Getting To Proof Points." Https://Community.solutions, Mar. 2018, Accessed 4 Oct. 2021.

Koegel, P., Burnam, M. A., & Baumohl, J. (2001). The causes of homelessness: an integrated perspective. Church & Society, 91(5), 41–47.

Ly, A., & Latimer, E. (2015). Housing First Impact on Costs and Associated Cost Offsets: A Review of the Literature. Canadian journal of psychiatry. Revue canadienne de psychiatrie, 60(11), 475–487.

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Population Health and Public Health Practice; Policy and Global Affairs; Science and Technology for Sustainability Program; Committee on an Evaluation of Permanent Supportive Housing Programs for Homeless Individuals. Permanent Supportive Housing: Evaluating the Evidence for Improving Health Outcomes Among People Experiencing Chronic Homelessness. Washington (DC): National Academies Press (US); 2018 Jul 11. Appendix B, The History of Homelessness in the United States. Available from: https://www.ncbi.nlm.nih.gov/books/NBK519584/

Ranney, Kaitilyn. "Lake County, Illinois: Veteran Functional Zero Case Study." Https://Community.solutions, 27 Jan. 2021, https://community.solutions/case-studies/lake county-illinois-functional-zero-case-study/. Accessed 4 Oct. 2021.

Rossi, Peter henry. Down and out in America: The Origins of Homelessness. University of Chicago Press, 1989.

Robertson, Marjorie J. Homelessness: A National Perspective. Plenum Press, 1992.

Stid, Daniel. " Dismantling the Social Services Industrial Complex." Washington Post, 25 Apr. 2012.

Thomas, H., & United States (issuing body) (2019). Understanding Rapid Re-housing: Findings From Initial Interviews With Rapid Re-housing Participants. Washington, DC: U.S. Department of Housing and Urban Development, Office of Policy Development and Research.