Between April 2014 and October 2015, residents of Flint, Michigan were exposed to a myriad of contaminants and irritants in their drinking water including lead, bacteria, excessive chlorine, total trihalomethanes, legionella, and increased corrosivity. Early manifestations of water concerns included skin conditions such as rashes and hair loss, yet few studies have examined these dermatological outcomes. The Flint Rash Investigation, completed in 2016, interviewed 390 Flint residents who had reported rashes, of which, 122 were examined by dermatologists. Of the 122 patients examined, 19.7% had rashes that were determined to be unrelated to the water exposure. This leaves over 80% of skin concerns that may have been related to the water.

Aims:
1) To characterize the number of self-reported dermatological issues related to water usage, specifically with bathing/showering
2) Report on open-ended responses related to worsened skin, hair, and/or nail findings

Methods
The Flint Registry gathers data to better understand the impact of the Flint Water Crisis and to connect participants to resources. Criteria for inclusion were those who were exposed to the water because they lived, worked, and/or attended school in Flint between April 2014 and October 2015. As part of the Flint Registry, participants completed an extensive questionnaire that included questions on skin conditions and rashes. Specifically, respondents were asked about rashes that developed during or after the extensive questionnaire that included questions on skin conditions and rashes.

Results
1) Self-reported rashes were more than twice as frequent in children as in adults. Of the 122 cases examined, 107 were identified as being related to the water. Of these 107 patients, 64% were children and 36% were adults, demonstrating a significant difference in the impact of the water crisis on adults versus children.
2) Of the 122 cases examined, 75% were identified as being related to the water.
3) The majority of patients reported worsening of their rash after April 2014.
4) The majority of patients reported improvement of their rash following the switch to alternative water supply in the summer of 2015.

Interpretations:
The effect of the water on skin rashes was not previously well known. Now, it is seen to be extensive. Overall, of all adult respondents that self-reported rashes or other skin conditions, 61.4% reported the skin rash was present between April 2014 and October 2015. Of those who self-reported a new skin rash between the study April 2014 and October 2015, 95.1% reported bathing daily and of those who had previous rashes and reported them worsening, 94.1% reported bathing daily. Less than half of the adults and children reported receiving a rash diagnosis from a healthcare provider and among those diagnosed with rashes, most reported being diagnosed after April 2014. Moreover, for those reporting a rash diagnosis, 75% of adults and 86.5% of children reported currently still having the rash at the time of the survey. When asked in an open-ended question about other health conditions that were created or worsened by the Flint water crisis, many respondents reported skin, hair, and/or nail conditions that developed or worsened following exposure.

Implications:
The Flint Rash Investigation was unable to generalize to the entirety of Flint due to the small sample size and convenience sampling. The Flint Registry provides a much larger sample size. We are able to see the amount of self-reported dermatological conditions and afflictions in both adults and children as well as if these were diagnosed by a provider. Additionally, this data can be understood in context of reported water use, including frequency of bathing.

Strengths and Limitations:
The largest limitation is that the rash is self-reported and relationship to the water crisis is based on reported timing data by the respondent. There is no way to know the true correlation between the two. Also, in children especially, they do not always bathe daily and may even be less likely to do so if they have a condition such as eczema. This makes examining the correlation between the water use and rash occurrence difficult. Additionally, information on diagnosis by a provider was also self-reported and must be cautiously interpreted as actual diagnosis is unknown and over half of reported rashes were never diagnosed by a medical provider. Strengths of the study include that the questionnaire was available in English and Spanish, it was accessible online, in print, and over the phone making it widely available, and there were over 13,000 responses.

Future Directions:
Further investigation needs to be done to understand and characterize the types of rashes being reported and the potential treatment for those affected. Additionally, an analysis of barriers that might have existed may help to elucidate trends in demographic differences to obtaining dermatologic care in Flint is necessary.