# A Review of Patient factors, Transfusion Practices, and Outcomes in Patients with Transfusion-Associated Circulatory Overload (TACO) at UCDMC in 2016-2017: A Quality of Care Change Pilot Program

Ananya Datta Mitra[1] MD, Hanne M Jensen MD[1]

[1]Department of Pathology & Laboratory Medicine, University of California Davis Medical Center, Sacramento, California

## Introduction

Transfusion-associated circulatory overload (TACO) is a severe pulmonary complication of blood transfusion and is the leading cause of major transfusion-related morbidity and mortality in France, the UK and the Netherlands, and the second leading cause in the United States. TACO is defined by the CDC NHSN (National health safety network) guideline as the onset of any three of the following six symptoms or signs occurring within six hours after transfusion: acute respiratory distress, elevated brain natriuretic peptide (BNP), elevated central venous pressure (CVP), evidence of congestive heart failure (CHF), evidence of positive fluid balance and radiographic evidence of pulmonary edema. Evidence supporting the diagnosis includes cardiac ultrasound, history of heart failure and increased pulmonary capillary wedge pressure or central venous pressure.

The 2015 Food and Drug Administration transfusion-related mortality report indicated that TACO accounts for 24% of reported deaths which is the second most common cause of transfusion related mortality after transfusion related acute lung injury (TRALI). Despite the high incidence and impact on mortality, TACO has received surprisingly little attention in the scientific literature.

Suggested strategies to prevent TACO include careful review of patient history and fluid status, administration of diuretic therapy to high-risk patients, ordering 1 red blood cell (RBC) unit at a time, using Factor 4/prothrombin complex instead of plasma, decreasing the transfusion rate in at-risk patients, and frequent nursing assessments. Despite these recommendations, TACO continues to occur and causes severe complications.

## Clinical problem

At UC Davis Health there are reports of occurrences of TACO, and to our knowledge, an assessment of the transfusion ordering practices in patients that go on to develop TACO has not been previously investigated. Our secondary project aim is to provide recommendations to clinicians regarding transfusion practices to prevent the occurrences of TACO and follow the effects of recommendations in preventing TACO at UCDMC. Our pilot program is a 'proof of concept' quality of care change project aiming to address the AABB standards in prevention and reporting of TACO.

## Methods

In order to identify the risk factors leading to the development of TACO, we divided the factors as patient factors and transfusion factors. For patient factors we retrospectively studied reported TACOs for years 2016 and 2017 and stratified the patient groups in different risk groups: high risk, moderate risk and low risk as per their ages and comorbidities. Then we studied the transfusion factors in terms of rate of transfusion, products implicated, net fluid gain and severity of development of TACO in these categories of patients. We also identified the need to partner with surgery/perioperative services, inpatient units of medicine and surgery, hematology-oncology, intensive care units (ICU), transfusion services and inpatient nursing.

In addition to identifying the risk factors in the development of TACO we also developed an algorithm describing the TACO prevention measures and educating the key stakeholders, responsible for patient care, during the Transfusion-Committee meetings in 2016. We further studied the effect of our recommendations in the transfusion practices and prevention of TACO in the following fiscal year 2017.

## Results

The low risk category of patients was identified as: patients <70years with no cardiac or renal compromise, the moderate risk category was identified as: patients>70 years with history of cardiac and or renal disease and the high risk patients were identified as: patients>70 years with history of congestive heart failure. In 2016, out of 209 total transfusion reactions, 16 TACOs were reported in total (7.6%). In 2017, there was a significant decrease in the number of TACOs reported; out of 165 total verified transfusion reactions, 9 TACOs were reported in total (5.4%). The majority of the products implicated in TACO at UCDMC in 2016-2017 were packed red cell transfusion; the rate of transfusion was 2 mL/kg/hr to approximately 25 mL/kg/hr in 2016 which was reduced to <1ml/kg/hr to approximately 12ml/kg/hr in 2017. We presented our data to the Transfusion Committee in 2017.

## Results
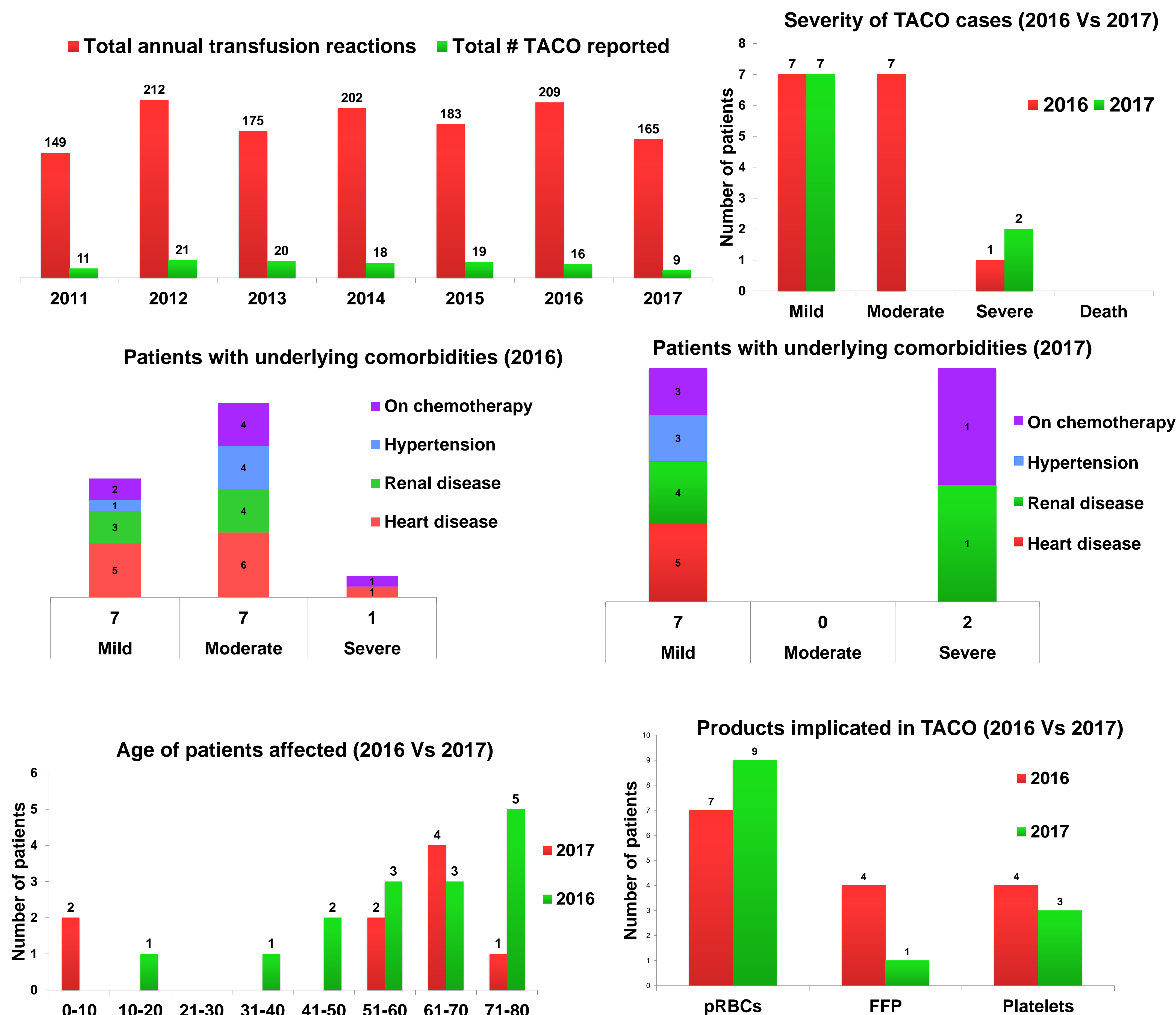


## Discussion

Our study highlights the patient risk factors, pretransfusion fluid status assessment, infusion practices, reaction management, and patient outcomes in a cohort of patients with TACO at UCDMC. Most of the TACO patients had at least 1 underlying risk factor for the development of TACO identified, including age more than 70 years, CHF, or chronic renal insufficiency. Despite these risk factors, physicians rarely assessed their patients' fluid status before ordering a transfusion, ordered large volumes of transfusions at excessive rates, and ordered diuretics infrequently. Our recommendations as per AABB standards to prevent TACO were proven to be useful in reducing the number of TACOs as well as improved the transfusion practices wisely by assessing the patients' comorbidities and using diuretics pre-transfusion with also reducing the rates of transfusion. The TACO has significantly decreased with plasma products ( 4 cases in 2016 to 1 case in 2017) after the decrease in the usage of the number of fresh frozen plasma products and increase in the usage of factor 4 Prothrombin Complex Concentrate prescribed in 2017 for cases of Warfarin reversal. We believe that our study will influence the transfusion practices here at UCDMC and prevent an avoidable cause of morbidity and mortality post-transfusion.