INTRODUCTION
Accuracy of the prepared dose and safety of staff is crucial in hazardous drug compounding. Even though hazardous drug compounding is perceived to be accurate, there has been estimated 5% to 15% error rates demonstrated in dose accuracy.1-3 Implementation of robotic hazardous drugs preparation has shown to increase both staff safety and accuracy of medication preparation.4 The objective of this study was to analyze and assess the uptake in use of the robotic IV admixture (RIVA) robot in preparation of hazardous and non-hazardous drugs.

METHODS
The study was designed to gather data from hospital’s informatics system, MediTech (MT), and RIVA’s system. From MT, all orders were identified for hazardous drugs (HD) currently prepared in RIVA* with order type “RIVABAG” and “RIVASYR” for November 2015 and January 2016. The order type signifies that those orders are eligible to be made in RIVA. Based on the order type, the percentage of orders were identified with “RIVABAG” and “RIVASYR” out of all orders.

After identification of all potential doses RIVA could have made, RIVA database was used to identify how many milligrams of each of the eligible drugs were made in RIVA in November 2015 and January 2016. Combining the information from MT and RIVA database, the percentage of doses that RIVA was calculated for each individual drugs as well as for all doses in November 2015 and January 2016.

The RIVA database was also used to identify the number of current non-hazardous drugs RIVA1 prepared for November 2015 and January 2016 as well as the average.

*Currently prepared HD in RIVA: gemcitabine, fluorouracil, oxaliplatin, irinotecan, leucovorin, vinorelbine, carboplatin, paclitaxel, doxorubicin
1Currently prepared non-HD in RIVA: ondansetron 8 mg, dexamethasone 10 mg, ranitidine 50 mg.

RESULTS
On average, 35% of all patient specific medications are prepared by RIVA at Humber River Hospital (chart 1). More specifically, 34% and 35% of patient specific medications were prepared in RIVA for November 2015 and January 2016 respectively.

Chart 2 shows the percentage of doses prepared in RIVA versus manually for RIVA eligible HD drugs. On average, 74% of doses are prepared in RIVA for all RIVA eligible drugs.

RIVA prepared, on average, 164 doses of ondansetron 8 mg, 186 doses of dexamethasone 10 mg, and 15 doses of ranitidine 50 mg in a month (chart 3). For the month of November 2015 and January 2016. This was 100% of all the doses.

DISCUSSION
In order to increase dose accuracy and staff safety, Humber River Hospital invested in robotic technology for HD and non-HD preparation in the outpatient oncology clinic. Our preliminary data, based on two out of four months of using RIVA, show that approximately 1 out of 3 doses is being prepared by the robot in addition to all doses for selected non-HD (batched doses).

During our use of RIVA, we have identified key strengths and limitations of robotic IV admixture:

Strengths:
- Bar code verification: systematic confirmation of drugs and fluids used in HD and non-HD preparation.
- Auditability: digital images stored for each dose prepared provide visual confirmation of the steps. This also allows for easy retrieval of lot used for medications and fluids, as required by OCP standard.
- Gravimetric checking: using the specific gravity of a solution ensures that the correct amount of each ingredient has been added to the compounding mixture.

Limitations:
- CSTD: currently RIVA is not compatible with the majority of Closed System Transfer Device (CSTD). This presents a significant challenge for HD medications to be compounded in RIVA. While RIVA is a closed system, CSTD is required for administration.

To continually assess the use of RIVA at Humber River Hospital, future studies to focus on preparation time for manual versus RIVA production.

CONCLUSION
At Humber River Hospital, RIVA prepared approximately 1 out of 3 patient specific doses and selected non-HD doses. The goal of using robotics for compounding is to increase dose accuracy and reduce staff exposure to HD. For future direction, the aim is to prepare approximately 75% of all patient specific doses in RIVA.

REFERENCES