A scenic mountain landscape with a lake and snow-capped peaks. The foreground is filled with green pine trees and rocky terrain. In the middle ground, a calm blue lake reflects the sky. The background features rugged mountains with patches of snow under a clear blue sky.

# **MONTANA EARLY WARNING SYSTEM AND COLLEGE READINESS SYSTEM**

**PRESENTED BY  
BRETT CARTER  
DATA ANALYST  
OPI**

# STATEWIDE LONGITUDINAL DATA SYSTEM (SLDS)

*Since 2009, the OPI has been working on a SLDS to research student achievement outcomes in Montana (GEMS)*

<https://gems.opi.mt.gov/Pages/HomePage.aspx>

Analyze and understand student, educator and local education agency data in Montana

Establish a linkage between students in the K-12 system and the postsecondary system in Montana

Create an electronic transport and transcript system that would allow for:

- a) OPI to collect transcript level data to address a specific set of college readiness research objectives
- b) Provide a free mechanism for schools, counselors, registrars, parents and students to view and send transcripts.

**This SLDS system (What we call GEMS) is where the EWS and the CRIS systems live**



# WHAT IS THE MONTANA EWS?

- A statistical model that can use readily available school, student, and other live data to identify students who are at risk of dropping out of school before they drop out.
  - The EWS allows educators to intervene early on during the process before a student has reached the point of no return.



# HOW IS THE EWS DEVELOPED?

- Compare data from dropouts to the data from high school graduates from the school years 2007-2018
- Model is found using Logistic Regression

$$\pi(x) = \frac{e^{\alpha + \beta x_1 + \beta x_2 + \dots + \beta x_n}}{1 + e^{\alpha + \beta x_1 + \beta x_2 + \dots + \beta x_n}}$$

- $\pi(x)$  is the percent chance a student will drop out of school
- Separate model is developed for each grades 3-8 and for each year of high school.

# WHAT DATA IS AVAILABLE FOR THE MODEL?

- Data stored by the State.

- Student Data

- SIS (AIM) Data
- Testing Data

- School data

- School Demographics
- Location

- Census Information

- Unemployment Rates
- Populations

- Data stored by the Schools

- Attendance
- Transcripts
- Grades
- Discipline



# EWS MODEL DATASET

- Data from all Graduates and Dropouts from 2007-2018 school years at 13 school system's in Montana.
  - 13 school system's in Montana were sampled to give a good representation of schools across the state. (roughly 11,000 students per year, or about 1/6<sup>th</sup> of the statewide students in 6-12<sup>th</sup> grades)
- Data current for each student at the end of the enrollment (whether a dropout or graduate)

# EWS HISTORY

- **Pilot Year 2012-2013 (10 School Systems involved)**
  - For the 2012-2013 school year EWS Results were sent to each school once a month
  - EWS was changed and updated many times during the school year.
- **2<sup>nd</sup> Year of EWS 2013-2014**
  - Model was updated during the previous summer and remained unchanged throughout the 2013-2014 school year.
- **3<sup>rd</sup> Year of EWS 2014-2015**
  - New model uses less variables that OPI does not collect (9 total)
- **4<sup>th</sup> Year of EWS 2015-2016**
  - Available to all schools in GEMS
- **5<sup>th</sup> Year of EWS 2016 – 2017**
  - Updates to current reports
- **6<sup>th</sup> Year of EWS 2017-2018**
  - Updated Models
- **7<sup>th</sup> year of EWS 2018-2019**
  - Models for grades 3-12 available and Intervention Report



# SCHOOL SYSTEMS CURRENTLY IN EWS

- Arlee
- Belgrade
- Bozeman
- Browning
- Butte
- Columbus
- Colstrip
- Corvallis
- Cut Bank
- Deer Lodge
- Frenchtown
- Great Falls
- Havre
- Hays-Lodge Pole
- Heart Butte
- Huntley Project
- Lame Deer
- Laurel
- Lewistown
- Libby
- Livingston
- Missoula
- Park City
- Polson
- Red Lodge
- St. Ignatius
- Townsend
- Wolf Point
- Whitehall

# VARIABLES IN THE EWS MODEL

## Collected by OPI

- Moved this school year (Y or N)
- Moved from out of state (Y or N)
- Repeated a grade in K-8 (Y or N)
- Age Difference (July 15 cutoff date)\*
- Number of School systems attended since 2007
- Gender

## Not Collected by OPI

- Attendance Rate
- # of Previous Term F's
- # of Previous Term A's
- # of Behavior Events in last 120 days
- # of Out of School Suspension Events in last 3 years
- On Track (Y or N)
- # of Credits per year
- # of Absences in last 90 days
- # of Absences in last 60 days

About 300 Variables have been analyzed.

# TWO PARTS TO A GOOD EWS MODEL

## 1

- The Model should assign a high dropout percentage to students who end up dropping out.
  - Low dropout percentage to those that eventually graduate.
    - Can be evaluated by:
      - R squared
      - C-statistic
      - ROC Curves
      - Model AIC

## 2

- Model should be efficient in identifying dropouts above the cut-off threshold for targeting a student as At-Risk
  - A high percentage of At-Risk students end up being dropouts.
    - Can be evaluated by:
      - Confusion Matrix

# WHEN IS A STUDENT CONSIDERED AT RISK?

- At what dropout percentage should we be concerned about a student?
  - Depends on school
  - Depends on how many incorrect conclusions you will accept.
- We want to be able to identify as many dropouts as we possibly can.
- We want as many of the students as possible to be in one of the “True” boxes.
  - Small number of students in the “False” boxes.

<b>True Negative</b>	<b>False Negative</b>
<b>Model: Graduate Student: Graduate</b>	<b>Model: Graduate Student: Dropout</b>
<b>False Positive</b>	<b>True Positive</b>
<b>Model: Dropout Student: Graduate</b>	<b>Model: Dropout Student: Dropout</b>

# GEMS EWS RESULTS

- <http://gems.opi.mt.gov/StudentCharacteristics/Pages/EarlyWarningSystemOverview.aspx>
- EWS Results only available in GEMS Secure
  - Must get a login and access rights to the page.
- 3 Reports in GEMS (Intervention Report coming soon)
  - School Report
  - Student Summary Report
  - Student Detail Report



# SCHOOL LEVEL REPORT

- Available for every school/district you have access to
  - School or district wide results to see numbers of students being identified.
- Can compare results by Grade
- Can compare to Statewide average results
- Will display results for the last 2 EWS runs



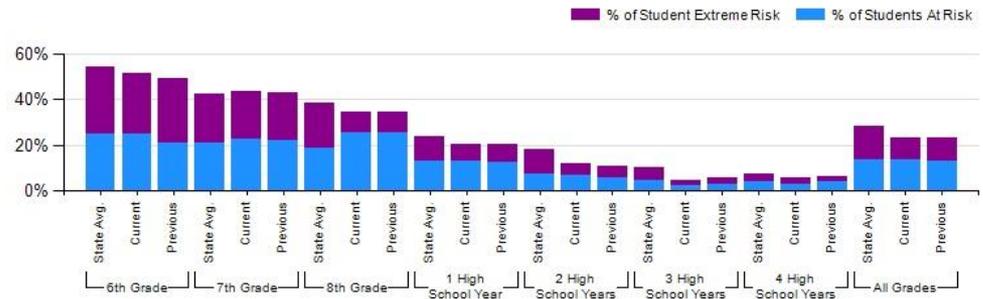
School Dashboard :  
(Masked)



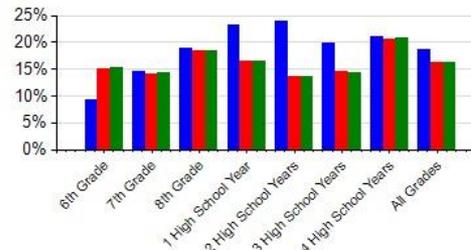
Category	Total	Percent of Total Students Enrolled	State Average
Students Missing Data	14	1.7%	0.6%
Students Identified	193	23.5%	28.2%
Students At - Risk	113	13.8%	13.7%
Students Extreme - Risk	80	9.7%	14.5%

Total Students Enrolled	(Masked)
Current EWS Run	04/20/2015
Previous EWS Run	04/14/2015
<a href="#">Student Summary Report (click for report)</a>	

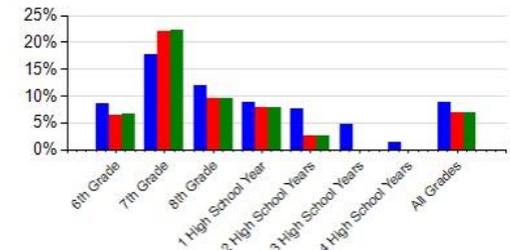
% Students Identified as At Risk



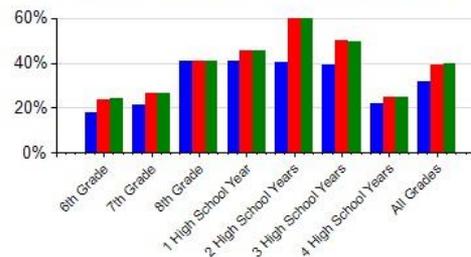
% Students flagged for Grades Risk Factor



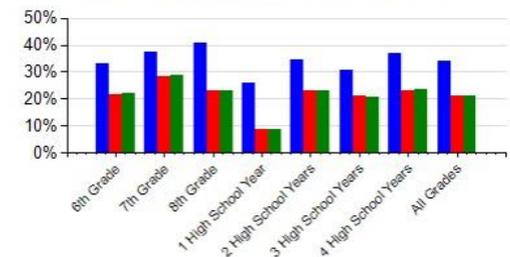
% Students flagged for Behavior Risk Factor



% Students flagged for Mobile Students Risk Factor



% Students flagged for Attendance Risk Factor



State Current EWS Run Previous EWS Run



# STUDENT SUMMARY REPORT

SC	School Name	Last Name	First Name	StateID	HS Years	Grade	Dropout Prob.	Change	Est.	Attendance	Grades	Behavior	Age	Off Track	Mobility	Previous Dropout Prob.	Behavior Odds	Attendance Odds	Grades Odds	Mobility Odds	
ABCD	Early Warning System School	Anderson	Joel	DJFHDFIEF	4	12	99.8%			Attendance	Grades			Off Track	Mobility	Prev Dropout	99.8%	1.00	41.45	61.25	2.21
ABCD	Early Warning System School	Smith	Maria	JDUEHJDH	4	12	0.1%			Attendance							0.1%	1.00	1.89	0.32	1.00
ABCD	Early Warning System School	Lackey	Edin	BGSFWFED	3	11	9.6%	↓		Attendance			Age				24.0%	1.00	2.80	0.78	1.00
ABCD	Early Warning System School	Underman	Hal	IKJJHYGVX	3	11	6.1%	↔		Attendance					Mobility		3.0%	1.22	3.23	0.57	3.19
ABCD	Early Warning System School	Grossman	Keith	JSUWEHDBH	2	10	3.9%			Attendance							3.8%	1.06	1.49	0.28	1.00
ABCD	Early Warning System School	Player	Joe	IJUJHHUUS	2	10	0.4%										0.2%	1.00	0.83	0.21	1.00
ABCD	Early Warning System School	Stein	Thomas	ODJEHDYST	1	09	70.2%	↑		Attendance	Grades	Behavior		Off Track			59.8%	2.92	2.95	6.14	1.00
ABCD	Early Warning System School	Caligher	Mary	DYSYDHEGD	1	09	1.8%			Attendance							2.1%	1.00	2.40	0.12	1.00
ABCD	Early Warning System School	Thompson	Jess	UDJEHEGDB	N/A	08	81.6%	↑	*	Attendance		Behavior	Age				69.0%	1.32	2.28	1.00	1.00
ABCD	Early Warning System School	Banby	Shane	MSJDHEYDG	N/A	08	8.3%	↔		Attendance			Age				6.4%	1.00	2.37	0.35	1.00
ABCD	Early Warning System School	Smith	Jane	NSHDHEYRG	N/A	07	76.5%	↓		Attendance	Grades						97.8%	1.00	3.59	8.46	1.00
ABCD	Early Warning System School	Anderson	Mike	MKNJBHGCC	N/A	07	13.7%	↓		Attendance							36.0%	1.00	1.39	1.06	1.00
ABCD	Early Warning System School	Abbott	Megan	HUGYFTDRE	N/A	06	50.2%	↑		Attendance		Behavior			Mobility		14.5%	1.85	1.39	0.62	4.92
ABCD	Early Warning System School	Cornrow	Mike	KDHSTDGXC	N/A	06	18.3%	↑		Attendance							6.6%	1.23	1.35	1.05	1.00

• Lists EWS results for every student in your district/school in an excel file (other formats available)

\* Names, School, and Data provided in the report is fictitious



# STUDENT LEVEL REPORT

- Available for every student enrolled in your school
- Displays all data used by the EWS Model
- Graphically displays the following
  - Dropout Probability
  - Grades Risk Factor
  - Attendance Risk Factor
  - Behavior Risk Factor
  - Mobility Risk Factor
- Will display results for up to the last 12 EWS results
- Attendance Risk Factor Example
  - Based on grades alone, the odds of this student dropping out is 11.18 times the odds of an average student, with all other factors held constant
  - Above 1.25 all risk factors are flagged

\* All names and data in report are fictitious \*



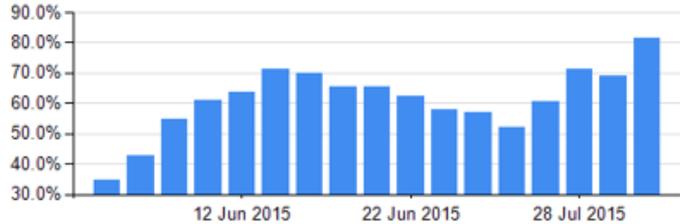
Student Level Report  
Student Name: Jess Thompson - UDJEHEGDB



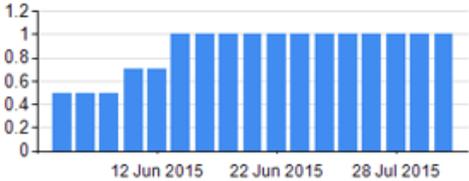
Jess Thompson		UDJEHEGDB		Extreme Risk																											
State ID	UDJEHEGDB	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #FFD700;">Dropout Probability</td> <td style="background-color: #FFD700; text-align: center;">81.6% *</td> <td style="text-align: center;">!</td> </tr> <tr> <td colspan="3" style="text-align: center; background-color: #FFD700;">Dropout Risk Factors</td> </tr> <tr> <td style="background-color: #FFD700;">Older Student</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">!</td> </tr> <tr> <td style="background-color: #FFD700;">Off Track</td> <td style="text-align: center;">N</td> <td></td> </tr> <tr> <td style="background-color: #FFD700;">Previous Dropout</td> <td style="text-align: center;">N</td> <td></td> </tr> <tr> <td style="background-color: #FFD700;">Attendance Risk Factor</td> <td style="text-align: center;">2.28</td> <td style="text-align: center;">!</td> </tr> <tr> <td style="background-color: #FFD700;">Grades Risk Factor</td> <td style="text-align: center;">1.00</td> <td></td> </tr> <tr> <td style="background-color: #FFD700;">Behavior Risk Factor</td> <td style="text-align: center;">1.32</td> <td style="text-align: center;">!</td> </tr> <tr> <td style="background-color: #FFD700;">Mobility Risk Factor</td> <td style="text-align: center;">1.00</td> <td></td> </tr> </table>		Dropout Probability	81.6% *	!	Dropout Risk Factors			Older Student	Y	!	Off Track	N		Previous Dropout	N		Attendance Risk Factor	2.28	!	Grades Risk Factor	1.00		Behavior Risk Factor	1.32	!	Mobility Risk Factor	1.00		
Dropout Probability	81.6% *			!																											
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Older Student	Y			!																											
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Attendance Risk Factor	2.28			!																											
Grades Risk Factor	1.00																														
Behavior Risk Factor	1.32			!																											
Mobility Risk Factor	1.00																														
Grade	08																														
Age	15																														
Gender	F																														
Birth Date	Jun 5 1999																														
Previous Dropout	N																														
Repeater K-8 Grade	N																														
Age Difference	Over 2 Up																														
Moved This School Year	N																														
Moved From Out Of State	N																														
More Than 2 School Systems Attended	N																														
Number of HS years	N/A																														
Attendance Rate	0.901																														
<b>Previous Term F's</b>																															
<b>Previous Term A's</b>																															
Behavior Events In Last 120 Days	1																														
Out Of School Suspension Events In Last 3 Years	1																														
<b>Credit Yr</b>																															
On Track	Y																														
Absences Last 60 days	5.25																														
Absense last 90 days	3.2																														

Dropout Probability Summary		
Dates Early Warning System Ran	Dropout Probability	Change
28 Aug 2015	81.6%	!
29 Jul 2015	69.0%	!
28 Jul 2015	71.1%	!
09 Jul 2015	60.5%	!
30 Jun 2015	52.1%	!
24 Jun 2015	57.0%	
23 Jun 2015	57.7%	!
22 Jun 2015	62.2%	!
19 Jun 2015	65.5%	
17 Jun 2015	65.4%	!
16 Jun 2015	69.9%	!
15 Jun 2015	71.1%	!

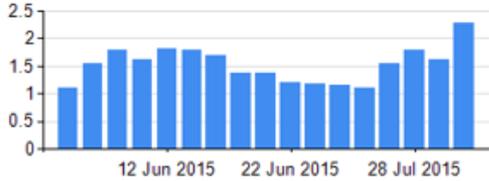
### Dropout Probability



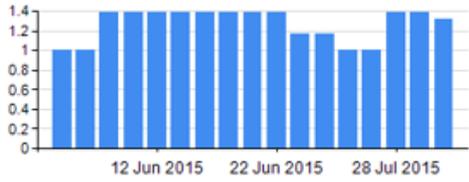
### Grades Risk Factor



### Attendance Risk Factor



### Behavior Risk Factor

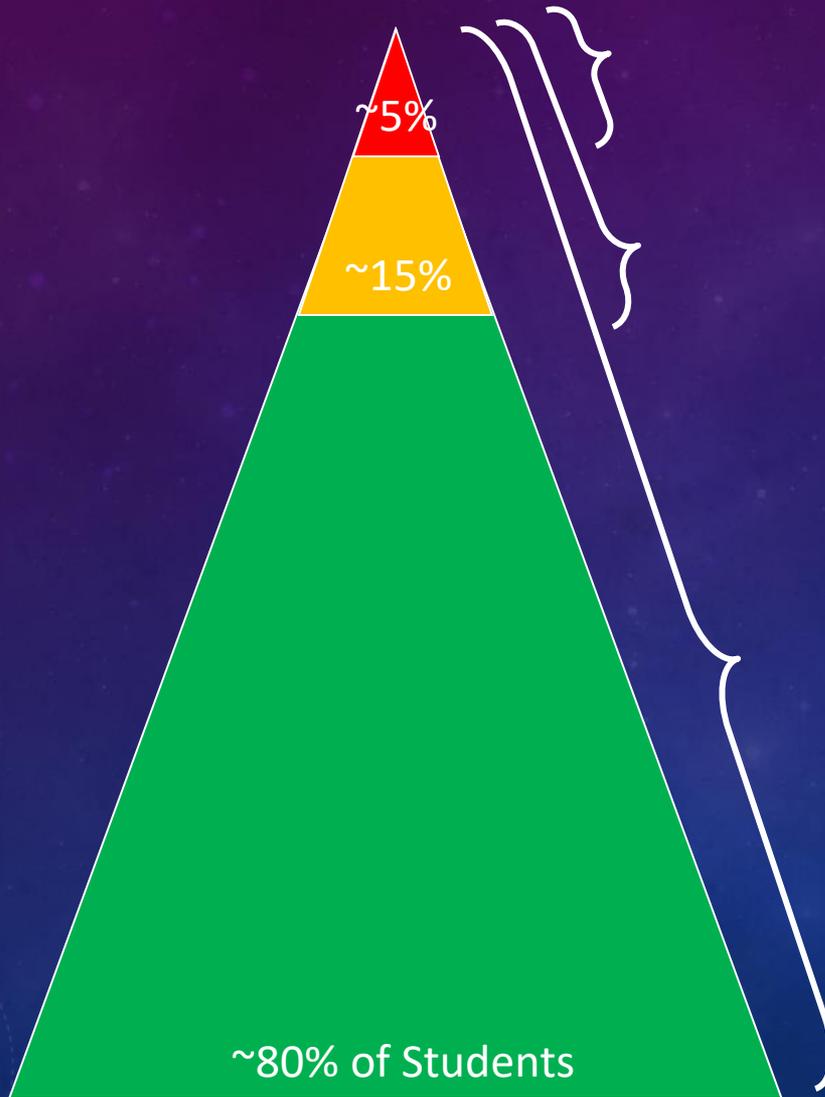


### Mobility Risk Factor





# At-Risk Tiers



## TIER 3 Tertiary Prevention

EWS: Extreme Risk – 11.0% of Students

## TIER 2 Secondary Prevention

EWS: At-Risk – 13.6% of Students

## TIER 1 Primary Prevention

EWS: Low Risk – 75.4% of Students

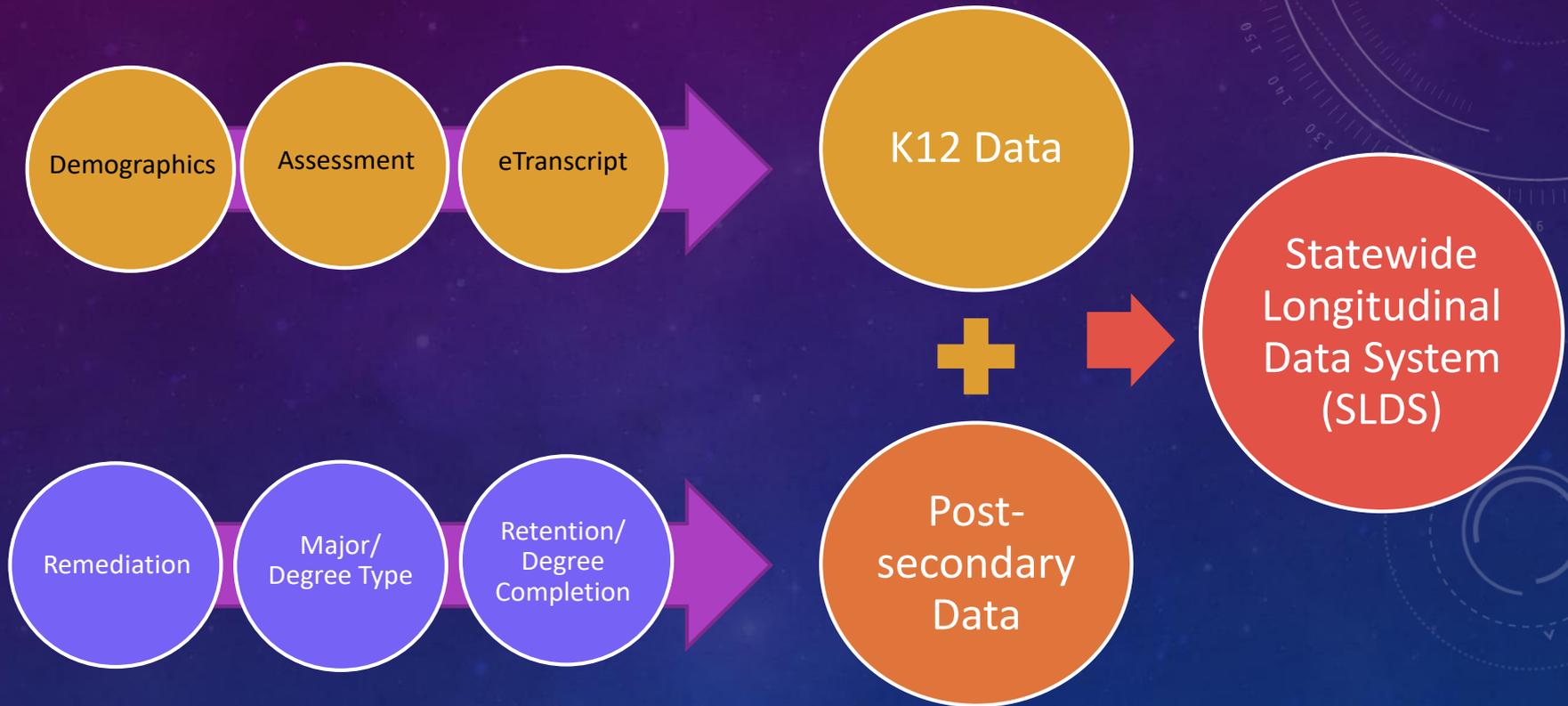
# RESOURCES

- Teacher Learning Hub Course (Using the Montana Early Warning System)
  - <http://learninghub.mrooms.net/>
    - Found in Self Paced courses in “Other” Section
- Montana Early Warning System Manual
  - <http://gems.opi.mt.gov/StudentCharacteristics/Pages/EarlyWarningSystemOverview.aspx>
- Infinite Campus EWS Extract Manual
  - [http://opi.mt.gov/Reports-Data/AIM/index.php?gpm=1\\_8](http://opi.mt.gov/Reports-Data/AIM/index.php?gpm=1_8)



# MONTANA COLLEGE READINESS SYSTEM

## K20 DATA COLLECTION

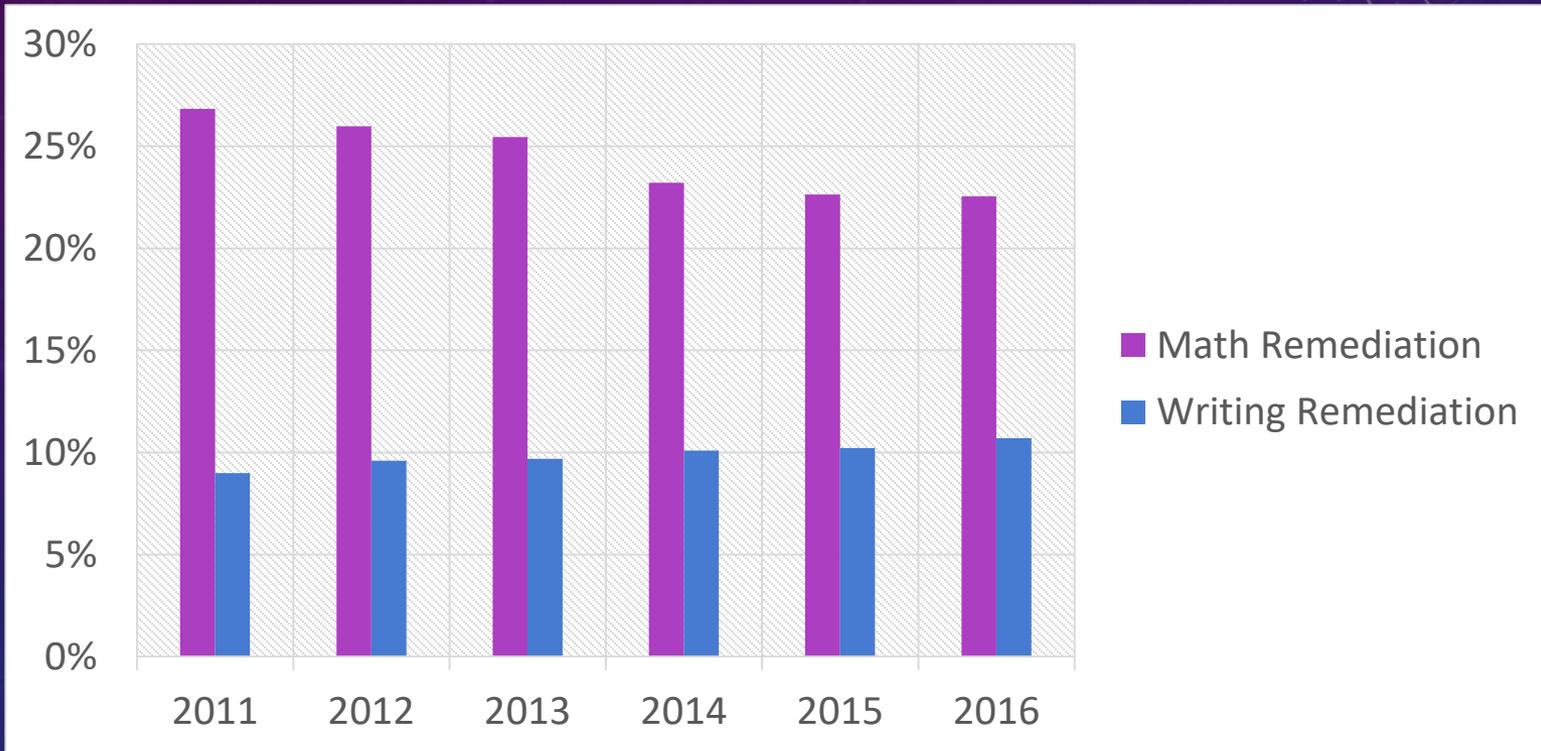




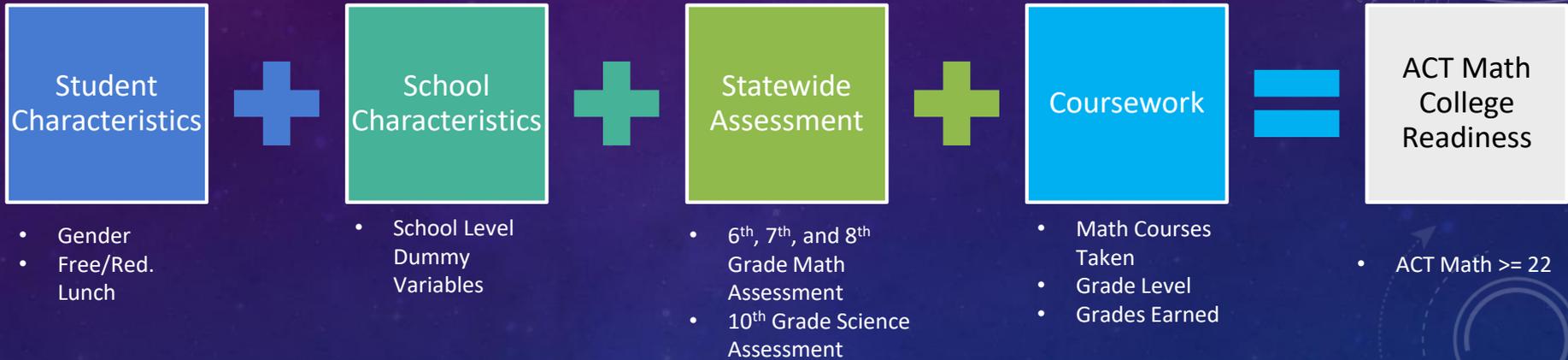
## Data Inputs

- Name, School, Address
- Credits earned, GPA, class rank, class size
- Graduation data
- Assessments – ACT and SAT
- **High School Coursework**
  - What courses taken
  - When courses were taken
  - What grades earned

## MONTANA GRADUATES AND MONTANA UNIVERSITY SYSTEM REMEDIATION



# ACT MATH & COLLEGE READINESS PREDICTION MODEL



# College Readiness Indicator System Student Summary Report

State/District/School

[View Report](#)

1 of 2 ? Find | Next

## Data Definitions & Explanations

SC	School Name	Last Name	First Name	StateID	College Readiness Probability		GPA Factor	6th Grade Math Assessment Factor	7th Grade Math Assessment Factor	8th Grade Math Assessment Factor	10th Grade Science Assessment Factor	Number Math Courses Factor	Math Grades Factor
ABCD	Early Warning System School	Anderson	Joel	DJFHDFIEF	0.0%	↓	Yes	Yes			Yes		Yes
ABCD	Early Warning System School	Anderson	Mike	MKNJBHGCC	49.9%	→							
ABCD	Early Warning System School	Caligher	Mary	DYSYDHEGD	70.3%	↗							
ABCD	Early Warning System School	Cornrow	Mike	KDHSTDGXC	0.7%	↓			Yes		Yes	Yes	Yes
ABCD	Early Warning System School	Grossman	Keith	JSUWEHDBH	72.2%	↗							
ABCD	Early Warning System School	Lackey	Edin	BGSFWFED	49.8%	→						Yes	
ABCD	Early Warning System School	Player	Joe	IJJJHHUUS	98.3%	↗	Yes						
ABCD	Early Warning System School	Smith	Jane	NSHDHEYRG	49.4%	→							
ABCD	Early Warning System School	Smith	Maria	JDUEHJDH	68.7%	→	Yes				Yes		
ABCD	Early Warning System School	Thompson	Jess	UDJEHEGDB	1.7%	↓			Yes				



Data Definitions & Explanations

Maria Smith	JDUEHJDH	Medium
-------------	----------	--------

StateID	JDUEHJDH	College Readiness Probability	69 %
Gender	Female	Predicted ACT Math Score Range	20 - 25
Economically Disadvantaged	No	Date Calculation Made	11/09/2018
		Transcript Certification Date	06/08/2018
Student GPA	2.324		
Median GPA Statewide	2.974		

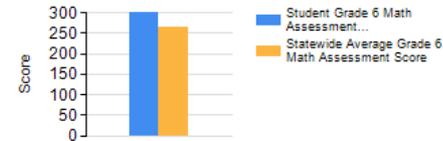
Math Courses Taken	4
Average Number Taken Statewide	3.46
PreAlgebra GPA	NA
Grade PreAlgebra Taken	NA
Algebra I GPA	2.85
Grade Algebra I Taken	09
Geometry GPA	1.65
Grade Geometry Taken	10
Algebra II/Trig GPA	NA
Grade Algebra II/Trig Taken	NA
PreCalculus GPA	NA
Grade PreCalculus Taken	NA
Calculus GPA	NA
Grade Calculus Taken	NA

PSAT Math Score	Not Taken
AP Math Exam Passed	No

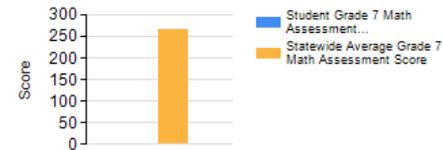
College Readiness Risk Factors

Overall GPA	Yes
Math Course Grades	No
Number Math Courses Taken	No
6th Grade Math Assessment	No
7th Grade Math Assessment	No
8th Grade Math Assessment	No
10th Grade Science Assessment	Yes

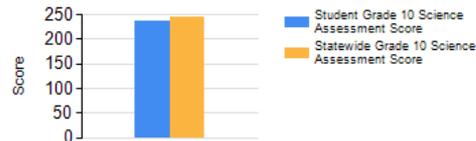
6th Grade Math Assessment



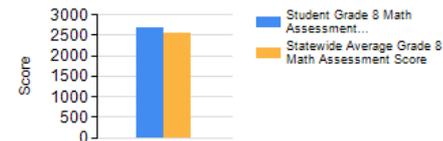
7th Grade Math Assessment



10th Grade Science Assessment



8th Grade Math Assessment



## NEXT STEPS

- Pilot at school level - Get information to counselors, teachers, staff, and students
- Collect feedback and refine model
- Moving from small sample to statewide scale
- Answering other research questions and deepening understanding of the factors that lead to college readiness
- How do various college tracks (e.g. majors) differ in terms of readiness?
- How do measures of college readiness translate to retention and degree completion?
- What factors determine the likelihood of needing writing remediation?
- What about Career Readiness or Military Readiness?





# CONTACT INFORMATION

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