# Multi-Drug Resistant Organisms (MDROs)

# Reported to the DPHSS from Morbidity Reports 2009-2020

# and from the

# Guam Memorial Hospital Authority (GMHA) 2016-2020

**Office of Epidemiology and Research**

**Department of Public Health and Social Services**
**Government of Guam**
**May 12, 2021**

All clinics and hospitals on Guam report to the Department of Public Health and Social Services (DPHSS) any infectious diseases of significance, which are included in the Guam Official Reportable Disease List.[1] This on-going collaboration also includes summary morbidity data on reportable infectious diseases, including multi-drug resistant organisms (MDRO's).

Multi-drug resistant organisms (MDRO's) are an important public health problem because, by definition, these bacteria and other micro-organisms have developed resistance to one or more classes of anti-microbial drugs.[2,3] An example is Methicillin resistant Staphylococcus aureus or MRSA. MRSA is the most common MDRO reported on Guam (Figures 1 and 2). Notice that there is a definitive decrease in reported MDRO's as a result of the SARS-CoV-2/COVID-19 pandemic.

Figure 1 illustrates how MRSA comprises Guam's main MDRO, which has been increasing each year since 2009. Figure 2, which omits MRSA, shows that Guam has increasing problems with MDRO's, including Escherichia (E. coli), Acinetobacter, Klebsiella and Pseudomonas. The data for 2009-2020 are provide in Table 1. All MDRO's are showing increases since 2009, except as noted above, for the decrease in MDRO's due to SARS-CoV-2/COVID-19 pandemic. Guam does have a problem with the ESBL producing bacteria. This stands for "Extended Spectrum Beta-Lactamase" which is produced by some bacteria of the Enterobacter family, such as Escherichia coli and Klebsiella pneumonia. The reason this is significant is ESBL enzymes break down and destroy some commonly used antibiotics and make these drugs ineffective for treating infections. Most infections associated with ESBLs have been associated with poor outcomes based on literature.

The Guam Memorial Hospital Authority (GMHA) is the public hospital utilized by the people of Guam. The GMHA provides real-time notification to the Department of Public Health and Social Services (DPHSS) of any infectious diseases of significance and weekly data on syndromic

surveillance of diseases related to potential outbreaks. This on-going DPHSS and GMHA collaboration also includes summary morbidity data on reportable infectious diseases on a monthly basis, including multi-drug resistant organisms (MDRO's).

Five years of data (2016-2020) on multi-drug resistant organisms (MDRO's) at GMHA, were compiled and analyzed, utilizing the definition of HAI from the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network's Report Identifying Healthcare-associated infections (HAI) for NHSN Surveillance, whereby "an infection is considered a Healthcare-associated infection (HAI) if the date of event of the NHSN site-specific infection criterion occurs on or after the 3rd calendar day of admission to an inpatient location where day of admission is calendar day 1."[2] Utilizing the date of admission to the hospital and the date that the MDRO specimen was taken were the criteria used to define and HAI (i.e. the specimen date subtracted from the admission date). Therefore an infection occurring less than 3 days before hospitalization is defined as a community acquired infection, and a MDRO infection occurring 3 or more days after hospitalization, is considered a hospital acquired infection (HAI). Note that this is a basic measure that doesn't account for all variables associated with the treatment and/or reporting of MDROs.

Data analysis (Table 2, Figure 3) shows that hospital acquired infections (HAI) from 2016-2020 at GMHA, utilizing the NHSN definition, include 60.1% of Acinetobacter baumanii, 74.1% of Chryseobacterium and 66.7% of Elizabethkingia organisms. E.coli was more likely to be community acquired (83.1%) than hospital acquired (16.9%), as was Achromobacter Xylosoxidans (66.7% community acquired and 33.3% hospital acquired), MRSA (81.1% community acquired and 19.9% hospital acquired), Klebsiella (78.2% community acquired and 21.8% hospital acquired), VRE (68% community acquired and 32% hospital acquired) along with 95.1% of mycobacterium and 100% of MTB (community acquired). Slightly more than one-half of Enterobacter (57.1%), Entercoccus (52.5%), Proteus (64.3%) and Pseudomonas (54.2%) were community acquired, with almost

one-half hospital acquired: Enterobacter (42.9%), Enterococcus (47.5%), Pseudomonas (45.8%), along with just over one-third 35.7% Proteus. Notice that the GMHA reported MDRO's also decreased in 2020, however MDRO's at GMHA have shown decreases for several years prior to 2020, showing that infection control practices implemented by the GMHA Antimicrobial Stewardship Program (ASP) are working. The GMHA ASP charter states that the purpose is to serve as a panel of experts for reviewing and investigating multi-drug resistant cases and antibiotic reviews. This team seeks to improve and promote optimal clinical outcomes related to the use of antimicrobials by guiding appropriate selection of antimicrobial drug regimens, dose, duration of therapy, and route of administration and thus, reducing adverse events, and minimizing toxicity. The team consists of the GMHA Clinical Pharmacist (PharmD), Infectious Disease physician, Infection Preventionist, and Microbiology Supervisor.

The Guam Epidemiology and Laboratory Capacity (ELC) program participates in two key CDC funded grant activities related to the prevention and abatement of MDRO's: an Infection Prevention Control (IPC) project and an overall set of activities related to MDROs/HAI prevention. The Infection Prevention and Control (IPC) project completed an initial baseline assessment of clinics on the island is to determine existing infection prevention and control practices at the beginning of the COVID-19 pandemic. A second assessment is being conducted in 2021 to ensure widespread participation in infection prevention practices, including site visits to clinics and a more extensive survey of current IPC practices, as well as training on infection control practices, if needed. ELC program staff also attend meetings of the GMHA Infection Control Committee. Other activities are planned for MDRO/HAI prevention and anti-microbial stewardship as well as community health education about MDROs.

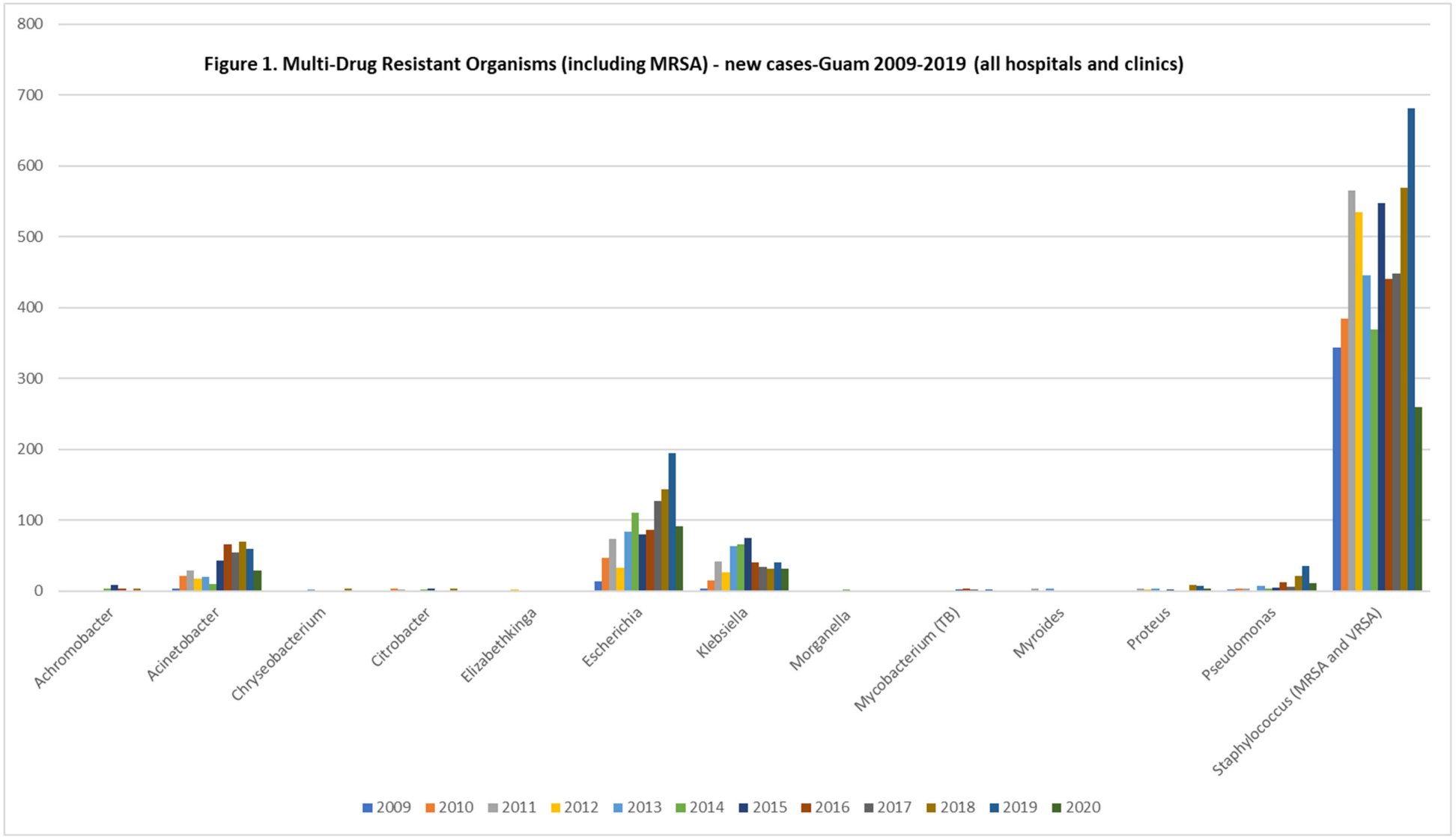
Figure 1. Multi-Drug Resistant Organisms (including MRSA) - new cases-Guam 2009-2019 (all hospitals and clinics)
800
700
600
500
400
300
200
100
0
Achromobacter
Acinetobacter
Chryseobacterium
Citrobacter
Elizabethkinga
Escherichia
Klebsiella
Morganella
Mycobacterium (TB)
Myroides
Proteus
Pseudomonas
Staphylococcus (MRSA and VRSA)
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

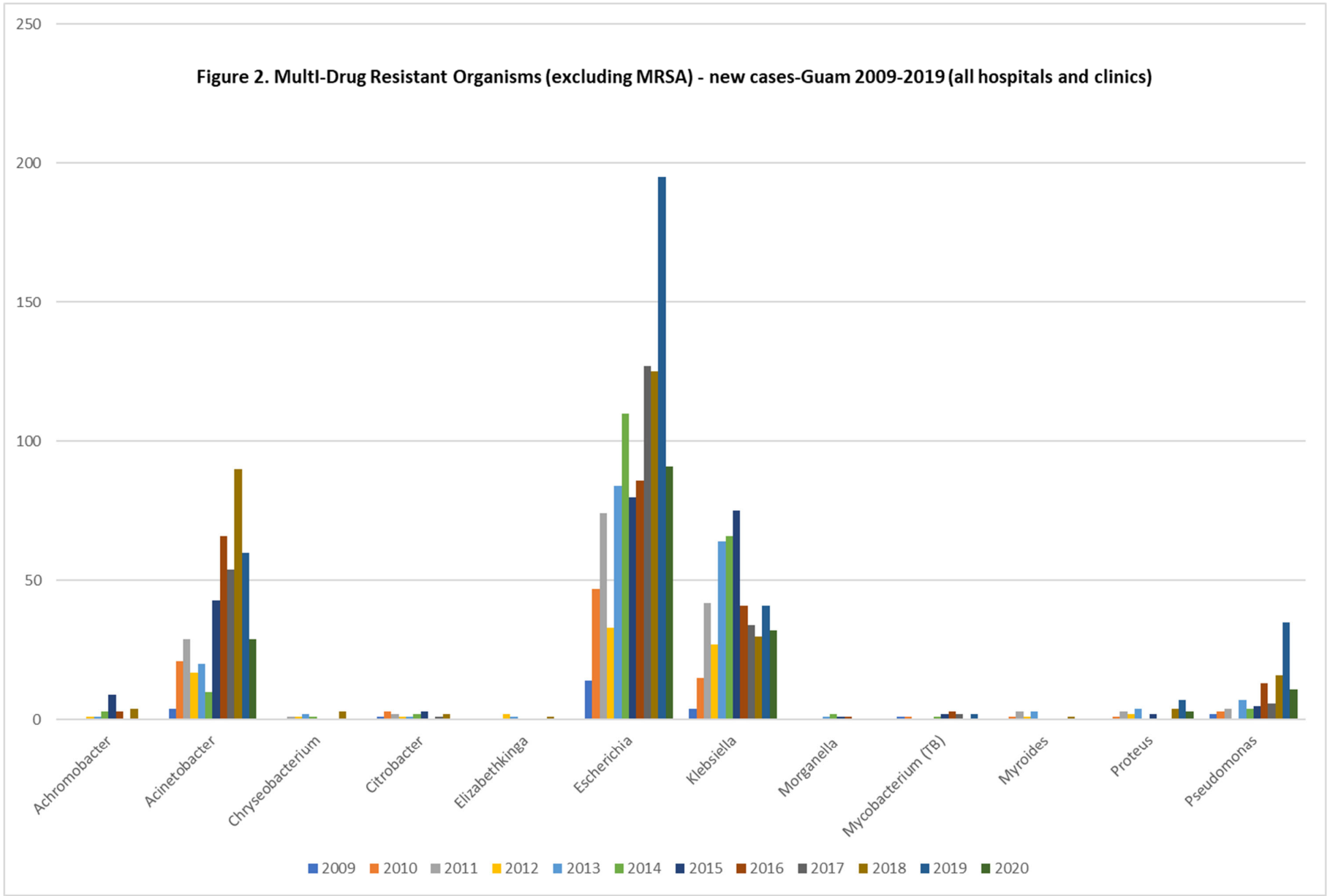
Figure 2. MultI-Drug Resistant Organisms (excluding MRSA) - new cases-Guam 2009-2019 (all hospitals and clinics)
250
200
150
100
50
0
Achromobacter
Acinetobacter
Chryseobacterium
Citrobacter
Elizabethkinga
Escherichia
Klebsiella
Morganella
Mycobacterium (TB)
Myroides
Proteus
Pseudomonas
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

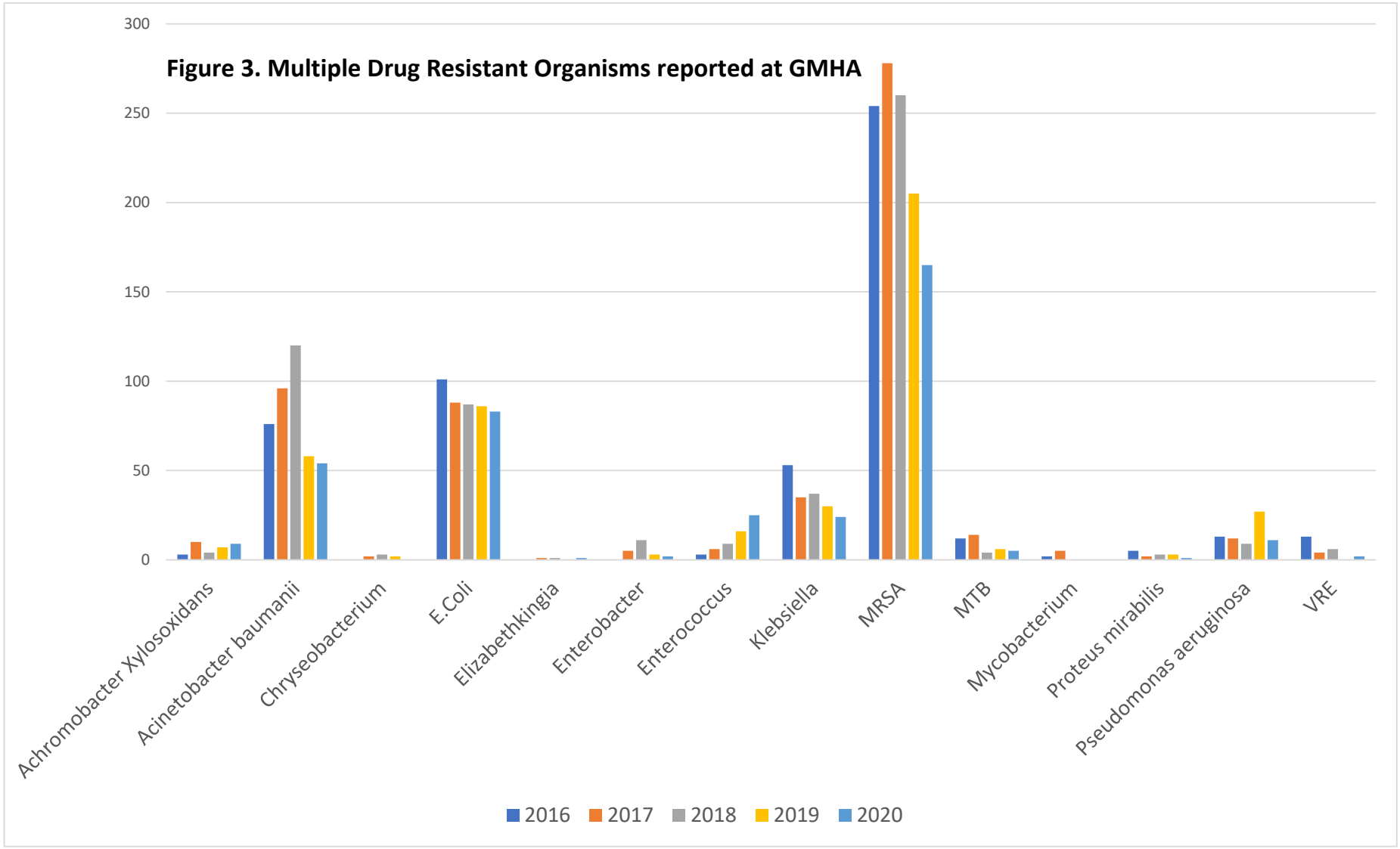
Figure 3. Multiple Drug Resistant Organisms reported at GMHA
300
250
200
150
100
50
0
Achromobacter Xylosoxidans
Acinetobacter baumanii
Chryseobacterium
E.Coli
Elizabethkingia
Enterobacter
Enterococcus
Klebsiella
MRSA
MTB
Mycobacterium
Proteus mirabilis
Pseudomonas aeruginosa
VRE
2016
2017
2018
2019
2020

In 2019 the Centers for Disease Control and Prevention released the latest report on Antibiotic Resistant Threats in the United States (2019 AR Threats Report).[5] The bacteria and fungi listed in the 2019 AR Threats Report include the following:

| | |
|---|---|
| **Urgent Threats:**<br><br>• Carbapenem-resistant *Acinetobacter*<br>• *Candida auris*<br>• *Clostridioides difficile*<br>• Carbapenem-resistant Enterobacterales<br>• Drug-resistant *Neisseria gonorrhoeae*<br><br>**Serious Threats:**<br><br>• Drug-resistant *Campylobacter*<br>• Drug-resistant *Candida*<br>• ESBL-producing Enterobacterales<br>• Vancomycin-resistant *Enterococci* (VRE)<br>• Multidrug-resistant *Pseudomonas aeruginosa*<br>• Drug-resistant nontyphoidal *Salmonella*<br>• Drug-resistant *Salmonella* serotype Typhi<br>• Drug-resistant *Shigella*<br>• Methicillin-resistant *Staphylococcus aureus* (MRSA)<br>• Drug-resistant *Streptococcus pneumoniae*<br>• Drug-resistant Tuberculosis | **Concerning Threats:**<br><br>• Erythromycin-Resistant Group A *Streptococcus*<br>• Clindamycin-resistant Group B *Streptococcus*<br><br>**Watch List:**<br><br>• Azole-resistant *Aspergillus fumigatus*<br>• Drug-resistant *Mycoplasma genitalium*<br>• Drug-resistant *Bordetella pertussis* |

[1] Official-Guam-Reportable-Disease-List-updated-12.29.2020.pdf

2 Centers for Disease Control and Prevention, National Healthcare Safety Network: https://www.cdc.gov/nhsn/index.html

[3] Centers for Disease Control and Prevention in Healthcare Settings-Background: https://www.cdc.gov/infectioncontrol/guidelines/mdro/background.html

[4] National Healthcare Safety Network January 2021. Identifying Healthcare-associated infections (HAI) for NHSN Surveillance, page 2-7: https://www.cdc.gov/nhsn/pdfs/pscmanual/2psc_identifyinghais_nhsncurrent.pdf

[5] Centers for Disease Control and Prevention, Infection Control in Healthcare Settings-Epidemiology: https://www.cdc.gov/infectioncontrol/guidelines/mdro/epidemiology.html

[6] Centers for Disease Control and Prevention Antibiotic Resistant Threats in the United States (2019 AR Threats Report).https://www.cdc.gov/drugresistance/biggest-threats.html

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| | Table 1: Multiple Drug Resistant Organisms (new cases) on Guam by Year from Morbidity Reports | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| *Achromobacter* | 0 | 0 | 0 | 1 | 1 | 3 | 9 | 3 | 0 | 3 | 0 | 0 |
| *Acinetobacter* | 4 | 21 | 29 | 17 | 20 | 10 | 43 | 66 | 54 | 70 | 60 | 29 |
| *Chryseobacterium* | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 |
| *Citrobacter* | 1 | 3 | 2 | 1 | 1 | 2 | 3 | 0 | 1 | 4 | 0 | 0 |
| *Elizabethkinga* | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Escherichia* | 14 | 47 | 74 | 33 | 84 | 110 | 80 | 86 | 127 | 144 | 195 | 91 |
| *Klebsiella* | 4 | 15 | 42 | 27 | 64 | 66 | 75 | 41 | 34 | 32 | 41 | 32 |
| *Morganella* | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 0 |
| *Mycobacterium (TB)* | 1 | 1 | 0 | 0 | 0 | 1 | 2 | 3 | 2 | 0 | 2 | 0 |
| *Myroides* | 0 | 1 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Proteus* | 0 | 1 | 3 | 2 | 4 | 0 | 2 | 0 | 0 | 9 | 7 | 3 |
| *Pseudomonas* | 2 | 3 | 4 | 0 | 7 | 4 | 5 | 13 | 6 | 21 | 35 | 11 |
| *Staphylococcus (MRSA and VRSA)* | 344 | 385 | 565 | 535 | 445 | 369 | 548 | 440 | 448 | 569 | 681 | 259 |
| *TOTAL* | 370 | 477 | 723 | 620 | 633 | 568 | 768 | 653 | 672 | 858 | 1021 | 425 |

**Table 2: Multi-drug resistance organisms reported at GMHA**

| | | 2016 | | | 2017 | | | 2018 | | | 2019 | | | 2020 | | | 5 year total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total |
| counts | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | |
| Achromobacter Xylosoxidans | 3 | 0 | 3 | 6 | 4 | 10 | 3 | 1 | 4 | 5 | 2 | 7 | 5 | 4 | 9 | 22 | 11 | 33 |
| Acinetobacter baumanii | 58 | 18 | 76 | 31 | 65 | 96 | 48 | 72 | 120 | 18 | 40 | 58 | 6 | 48 | 54 | 161 | 243 | 404 |
| Chryseobacterium | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 2 | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 2 | 5 | 7 |
| E.Coli | 88 | 13 | 101 | 70 | 18 | 88 | 74 | 13 | 87 | 68 | 18 | 86 | 70 | 13 | 83 | 370 | 75 | 445 |
| Elizabethkingia | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 |
| Enterobacter | 0 | 0 | 0 | 5 | 0 | 5 | 5 | 6 | 11 | 1 | 2 | 3 | 1 | 1 | 2 | 12 | 9 | 21 |
| Enterococcus | 3 | 0 | 3 | 1 | 5 | 6 | 2 | 7 | 9 | 9 | 7 | 16 | 16 | 9 | 25 | 31 | 28 | 59 |
| Klebsiella | 43 | 10 | 53 | 27 | 8 | 35 | 30 | 7 | 37 | 21 | 9 | 30 | 19 | 5 | 24 | 140 | 39 | 179 |
| MRSA | 239 | 15 | 254 | 225 | 53 | 278 | 194 | 66 | 260 | 156 | 49 | 205 | 128 | 37 | 165 | 942 | 220 | 1162 |
| MTB | 12 | 0 | 12 | 13 | 1 | 14 | 4 | 0 | 4 | 6 | 0 | 6 | 4 | 1 | 5 | 39 | 2 | 41 |
| Mycobacterium | 2 | 0 | 2 | 5 | 0 | 5 | | | | | | | | | | 7 | 0 | 7 |
| Proteus mirabilis | 5 | 0 | 5 | 2 | 0 | 2 | 0 | 3 | 3 | 2 | 1 | 3 | 0 | 1 | 1 | 9 | 5 | 14 |
| Pseudomonas aeruginosa | 11 | 2 | 13 | 8 | 4 | 12 | 8 | 1 | 9 | 10 | 17 | 27 | 2 | 9 | 11 | 39 | 33 | 72 |
| VRE | 10 | 3 | 13 | 2 | 2 | 4 | 4 | 2 | 6 | 0 | 0 | 0 | 1 | 1 | 2 | 17 | 8 | 25 |
| total | 474 | 61 | 535 | 396 | 162 | 558 | 373 | 181 | 554 | 297 | 146 | 443 | 252 | 130 | 382 | 1792 | 680 | 2472 |
| | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total | date difference | | ROW Total |
| percent | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | | less than 3 days | 3 + days | |
| Achromobacter Xylosoxidans | 100.0 | 0.0 | 100.0 | 60.0 | 40.0 | 100.0 | 75.0 | 25.0 | 100.0 | 71.4 | 28.6 | 100.0 | 55.6 | 44.4 | 100.0 | 66.7 | 33.3 | 100.0 |
| Acinetobacter baumanii | 76.3 | 23.7 | 100.0 | 32.3 | 67.7 | 100.0 | 40.0 | 60.0 | 100.0 | 31.0 | 69.0 | 100.0 | 11.1 | 88.9 | 100.0 | 39.9 | 60.1 | 100.0 |
| Chryseobacterium | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 33.3 | 66.7 | 100.0 | 50.0 | 50.0 | 100.0 | 0.0 | 0.0 | 0.0 | 28.6 | 71.4 | 100.0 |
| E.Coli | 87.1 | 12.9 | 100.0 | 79.5 | 20.5 | 100.0 | 85.1 | 14.9 | 100.0 | 79.1 | 20.9 | 100.0 | 84.3 | 15.7 | 100.0 | 83.1 | 16.9 | 100.0 |
| Elizabethkingia | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 33.3 | 66.7 | 100.0 |
| Enterobacter | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 100.0 | 45.5 | 54.5 | 100.0 | 33.3 | 66.7 | 100.0 | 50.0 | 50.0 | 100.0 | 57.1 | 42.9 | 100.0 |
| Enterococcus | 100.0 | 0.0 | 100.0 | 16.7 | 83.3 | 100.0 | 22.2 | 77.8 | 100.0 | 56.3 | 43.8 | 100.0 | 64.0 | 36.0 | 100.0 | 52.5 | 47.5 | 100.0 |
| Klebsiella | 81.1 | 18.9 | 100.0 | 77.1 | 22.9 | 100.0 | 81.1 | 18.9 | 100.0 | 70.0 | 30.0 | 100.0 | 79.2 | 20.8 | 100.0 | 78.2 | 21.8 | 100.0 |
| MRSA | 94.1 | 5.9 | 100.0 | 80.9 | 19.1 | 100.0 | 74.6 | 25.4 | 100.0 | 76.1 | 23.9 | 100.0 | 77.6 | 22.4 | 100.0 | 81.1 | 18.9 | 100.0 |
| MTB | 100.0 | 0.0 | 100.0 | 92.9 | 7.1 | 100.0 | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 100.0 | 80.0 | 20.0 | 100.0 | 95.1 | 4.9 | 100.0 |
| Mycobacterium | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 100.0 |
| Proteus mirabilis | 100.0 | 0.0 | 100.0 | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 | 100.0 | 66.7 | 33.3 | 100.0 | 0.0 | 100.0 | 100.0 | 64.3 | 35.7 | 100.0 |
| Pseudomonas aeruginosa | 84.6 | 15.4 | 100.0 | 66.7 | 33.3 | 100.0 | 88.9 | 11.1 | 100.0 | 37.0 | 63.0 | 100.0 | 18.2 | 81.8 | 100.0 | 54.2 | 45.8 | 100.0 |
| VRE | 76.9 | 23.1 | 100.0 | 50.0 | 50.0 | 100.0 | 66.7 | 33.3 | 100.0 | 0.0 | 0.0 | 0.0 | 50.0 | 50.0 | 100.0 | 68.0 | 32.0 | 100.0 |
| total | | | | | | | | | | | | | | | | | | |