TIMELINE: MARCH 2018

• 30 hours in UK
  • Friday 3/02: Alleged perpetrators arrive at Gatwick Airport from Moscow, travel to London
  • Saturday 3/03: Travel by train to Salisbury, then return
  • Sunday 3/04: Travel by train to Salisbury, then to the Scripal’s house about noon. They then return to London and leave UK for Moscow via Heathrow Airport

• Targets
  • Saturday 3/03: Yulia Skripol arrives at Heathrow from Russia
  • Sunday 3/04: Sergei & Yulia make contact with poison before going to lunch at 2:20pm
  • EMS initiated at 4:15pm

England's chief medical officer, Dame Sally Davies, estimated that around 500 people could have been affected in the time window. She insisted the risk to the public from the nerve agent remained low, but conceded that contact with the nerve agent, could pose a risk with "prolonged, long-term exposure" to the skin.
The fact that a nerve agent was used to do this is shocking. We are so lucky to have survived this attempted assassination.
DEVELOPING STORY

WILTSHIRE COUPLE POISONED BY NOVICHOK
Charlie Rowley and Dawn Sturgess were found unconscious on Sunday
Several places the couple visited or may have visited after they were exposed were locked down by police, including a church and Boots store. Ms Sturgess lives just 300 yards from Zizzi’s where the Skripals ate the day they were poisoned.
Sergei, 66, and Yulia, 33, were poisoned with chemical agent Novichok and found unconscious on a park bench in Salisbury on March 4. Pictured, the scene after the poisoning in Salisbury.

The sites targeted in the clean-up included three in Salisbury city centre - were sealed off from the public with secure fencing and protected by patrolling police and security guards.
IMPACT

- Acute illness
- Recovery
- Psychological trauma
- Economic loss
- Decontamination
- Investigation and Forensics
- “Precautionary” steps
- Terror

- Parks and open spaces
- Homes
- Homeless shelter
- Clothing
- Cars
- Stores
- Shopping mall
- Restaurant
- Church
WHEN DOES IT BECOME “SILLY?”
Novichok investigation moves to Swindon as police seize car

Police confirm the removal of the car is related to the "incident in Amesbury" but say the public should not be alarmed.

A car is wrapped in plastic film by personnel in military fatigues. Pic: James Street

A car has been seized by police in Swindon as the novichok poisoning investigation expands to a third area.

It was removed from a residential street in the Wiltshire town, with pictures on social media showing personnel in military fatigues and gas masks wrapping a white Audi in plastic film.

Swindon is around 40 miles from Salisbury, where Yulia and Sergei Skripal became the first novichok victims, and 33 miles from Amesbury where Dawn Sturgess fell ill after receiving what police described as a "high dose" of the nerve agent.
FEAR AND INCOMPLETE INFORMATION ARE THE BREEDING GROUND OF CONSPIRACY THEORIES

- Porton Downs was the source of the poison
- Inadequate decontamination after Salisbury
- Police officer exposed when responding to Scripols’ illness
- No links between groups of victims
- False flag attempt by UK to foment unrest during World Cup hosted by Russia
- Even a “few molecules” ingested or otherwise absorbed will make you sick
- Level A Personal Protective Equipment (PPE) is necessary for scene entry and patient care
- Fourth Generation Nerve Agents (A compounds) are persistent, non-volatile liquids
- The Amesbury couple were exposed to minute quantities of the Novichok poison
- Traces of FGA have been found in multiple places in southern England
Amesbury victim loaded into ambulance by medics wearing hazmat suit
CHEMICAL WARFARE \ NERVE AGENTS

PART ONE: THE G SERIES

THE G SERIES NERVE AGENTS ARE SO NAMED BECAUSE THEY WERE ALL FIRST SYNTHESISED IN GERMANY. THEY ARE ALL EXTREMELY TOXIC VOLATILE LIQUIDS, CLASSIFIED AS WEAPONS OF MASS DESTRUCTION BY THE U.N., AND THEIR PRODUCTION & STOCKPILING IS OUTLAWED.

**TABUN (GA)**
(ethyl dimethyl phosphorothioate)

**SARIN (GB)**
(isopropyl methylphosphonofluoridate)

**SOMAN (GD)**
(3,3-dimethylthiuran 2,2-dimethylphosphonofluoridate)

**CYCLOSARIN (GF)**
(cyclopropane methylphosphonofluoridate)

**SMELL & APPEARANCE**

Tabun: Colourless liquid, though impure tabun can have a brown appearance. Pure tabun is odourless, but it often has a faint, fishy odour due to impurities.

Sarin: A clear, colourless liquid, tasteless and odourless in its pure form. It's a volatile liquid, like other nerve gases the vapour generated is heavier than air.

Soman: A clear, colourless liquid, tasteless and odourless. Its odour is faint when pure, but when impure it has a yellow-brown colour and has a strong, camphoraceous odour.

Cyclosarin: Colourless liquid with a sweet, musty smell, sometimes likened to peaches. It evaporates around 70 times slower than sarin, and is also flammable.

**SYNTHESISED**

Tabun: Discovered accidentally by Gobberti Schneider, a German chemist who was investigating organophosphates as pesticides.

Sarin: Named after the team of scientists behind its initial discovery: Schrader, Ambros, Ritz & Van der Linds.

Soman: Discovered during research into the pharmacology of tabun & sarin funded by the German army.

Cyclosarin: Also a result of German research, Iraq is the only country known to have manufactured significant quantities.

**LETHALITY**

Tabun: Median lethal concentration: 400 micrograms per cubic metre, Median lethal dose: 4000 micrograms per person (skin exposure).

Sarin: Median lethal concentration: 100 micrograms per cubic metre, Median lethal dose: 1700 micrograms per person (skin exposure).

Soman: Median lethal concentration: 70 miligrams per cubic metre, Median lethal dose: 300 micrograms per person (skin exposure).

Cyclosarin: Median lethal concentration: 50 miligrams per cubic metre, Median lethal dose: 350 micrograms per person (skin exposure).

**EFFECTS OF NERVE AGENTS**

- ACh
  - Inhibit breakdown of acetylcholine
  - Cause constriction of the pupils
  - Excessive tears, lacrimation
  - Nausea, gastrointestinal pain & vomiting
  - Bronchoconstriction & chest tightness
  - Soreness, cramps & loss of bowel control
  - Convulsion & eventual death

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The V series nerve agents are highly toxic chemical warfare agents. The 'V' stands for 'Venomous'. They were discovered in the UK in the 1950s, and later VX was developed for military use by the United States, though it has never been used in warfare.

**VX**
- **Smell & Appearance**: Pure VX is a colourless liquid, but more commonly it is an amber-coloured, oily, odourless liquid.
- **Discovery**: The V series nerve agents were discovered during work to synthesise pesticides and insecticides. VX was originally sold as an insecticide, under the name 'Amiton'. It was marketed from 1954, but later withdrawn after the issues with human toxicity became apparent.
- **Usage & Fatalities**: VX is primarily used as a low volatility liquid. The only recorded human fatality as a result of VX in Japan in 1954, where it was used to incapacitate a former member. It may have also been used in Iraq by Saddam Hussein, though there is no conclusive evidence.
- **Lethality**: VX has a median lethal concentration of 15 milligrams per cubic metre.

**VE**
- **Smell & Appearance**: VE is a colourless liquid.
- **Discovery**: VE was discovered during the same work as VX.
- **Usage & Fatalities**: VE was used in Iraq by Saddam Hussein.
- **Lethality**: VE has a median lethal concentration of 10 milligrams per cubic metre.

**VG**
- **Smell & Appearance**: VG is a colourless liquid.
- **Discovery**: VG was discovered during the same work as VX.
- **Usage & Fatalities**: VG was used in Iraq by Saddam Hussein.
- **Lethality**: VG has a median lethal concentration of 10 milligrams per cubic metre.

**VM**
- **Smell & Appearance**: VM is a colourless liquid.
- **Discovery**: VM was discovered during the same work as VX.
- **Usage & Fatalities**: VM was used in Iraq by Saddam Hussein.
- **Lethality**: VM has a median lethal concentration of 10 milligrams per cubic metre.

**EFFECTS OF NERVE AGENTS**
- **ACH**: Inhibit breakdown of acetylcholine.
- **Eye**: Causes constriction of the pupils.
- **Gastrointestinal**: Excessive mucus, nausea, vomiting.
- **Neuromuscular**: Paralysis & chest tightness.
- **Skin**: Spots, oedema, loss of bowel control.
- **Nerve**: Convulsions & eventual death.
**WHAT ARE NOVICHOK AGENTS?**

Novichok agents are organophosphate nerve agents. They were reportedly developed in Russia from the 1970s onwards. Novichok agents are supposedly 5 to 8 times more deadly than VX, another deadly nerve agent.

**POTENTIAL STRUCTURES OF NOVICHOK AGENTS**

Exact structures of Novichok agents are unknown. The structures above are those suggested by Vil Mirzayanov, the Russian chemical weapons scientist who exposed their development. Nerve agent exposure is usually treated with atropine and pralidoxime.

**1970s–1990s**

- **median lethal dose**
  - 10 milligrams per person (skin exposure)

**EFFECTS OF NOVICHOK AGENTS**

- **ACh**
  - Stop breakdown of acetylcholine
- **Eye**
  - Cause contraction of the pupils
- **Respiratory**
  - Excessive mucus, tears, salina & sweat
  - Nausea, gastrointestinal pain & vomiting
  - Bronchoconstriction & chest tightness
  - Spasms, convulsions & loss of bowel control
- **CNS**
  - Cess & eventual death
ACETYLCHOLINE

THE SYNAPSE

Synaptic Vesicle
Neurotransmitters

Axon Terminal
Synaptic Cleft
Dendrite
NERVE AGENTS - RECOGNITION

- Cholinergic crisis
  - runny eyes and nose
  - nausea
  - dim vision secondary to miosis
  - bronchorrhea/bronchoconstriction
  - involuntary urination/defecation
- Fasciculations => Respiratory Failure
- Seizures
## Dermal vs Vapor Exposure

<table>
<thead>
<tr>
<th>Amount of Exposure</th>
<th>Dermal</th>
<th>Vapor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>diaphoresis &amp; muscle fasciculations at the site of exposure</td>
<td>miosis &amp; conjunctivitis rhinorrhea wheezing &amp; dyspnea</td>
</tr>
<tr>
<td>Moderate</td>
<td>increasing generalized muscarinic signs &amp; muscular weakness (may lack eye and resp sx)</td>
<td>increasing generalized muscarinic signs &amp; muscular weakness (pronounced dyspnea)</td>
</tr>
<tr>
<td>Severe</td>
<td>coma &amp; convulsions paralysis &amp; apnea</td>
<td>coma &amp; convulsions paralysis &amp; apnea</td>
</tr>
</tbody>
</table>
AUTONOMIC NERVOUS SYSTEM

• Parasympathetic
  • Acetylcholine

• Sympathetic
  • Acetylcholine => Norepinephrine
NERVE AGENT VS. “WITNESSED WORST EVENT OF YOUR LIFE”

<table>
<thead>
<tr>
<th>Nerve Agent Poisoning</th>
<th>“Stress Reaction”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Tightness</td>
<td>Chest Tightness</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>Dyspnea</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>Tachycardia</td>
</tr>
<tr>
<td>Nausea/Vomiting</td>
<td>Nausea/Vomiting</td>
</tr>
<tr>
<td>Abdominal Cramps</td>
<td>Abdominal Cramps</td>
</tr>
<tr>
<td>Involuntary Urination</td>
<td>Involuntary Urination</td>
</tr>
<tr>
<td>Fasciculations</td>
<td>Tremor</td>
</tr>
<tr>
<td>Headache</td>
<td>Headache</td>
</tr>
<tr>
<td>Coma</td>
<td>Syncope</td>
</tr>
<tr>
<td>Diaphoresis</td>
<td>Diaphoresis</td>
</tr>
<tr>
<td><strong>Pinpoint Pupils</strong></td>
<td><strong>Dilated Pupils</strong></td>
</tr>
</tbody>
</table>
British man poisoned by nerve agent fears he’ll die in 10 years

LONDON — A British man who was exposed to the deadly nerve agent Novichok says he is struggling with his eyesight and mobility, and fears the poison will kill him within a decade.

Charlie Rowley, 45, fell ill in June near Salisbury, England, after coming into contact with the nerve agent that was used months earlier to attack former Russian spy Sergei Skripal and his daughter. Rowley, Skripal and his daughter survived, but Rowley’s partner Dawn Sturgess, who was also exposed, died in the hospital.

Rowley told the Sunday Mirror newspaper that he was back in the hospital for treatment because he was going blind and unable to use one arm. He added: “I’m still worried the Novichok could kill me if I get any sort of virus again.”
NERVE AGENT INFORMATION FOR EMERGENCY MEDICAL SERVICES AND HOSPITALS

**Purpose**
This document provides a quick refresher on standard protocols for recognizing, treating, and protecting yourself from nerve agent exposures. Comprehensive training guidance for Law Enforcement, Fire, EMS, HazMat, and Hospital-Based First Receivers incorporating lessons learned and best practices from recent United Kingdom incidents will be forthcoming.

**Background**
Nerve agents are extremely toxic chemical warfare agents. Several nerve agents exist and are generally categorized as either “high volatility” or “low volatility” chemicals, a measure of how likely they are to disperse in air. A high volatility nerve agent (easily dispersed in air) means that the exposure is likely to occur from breathing its vapors resulting in the rapid onset of symptoms. A low volatility nerve agent (not easily dispersed in air) typically gets absorbed through the skin and has a delayed onset of symptoms and signs. An example of a high volatility nerve agent is sarin, whereas VX is a low volatility agent. In the body, a nerve agent exerts its effects by inhibiting an enzyme (acetylcholinesterase), resulting in acute illness—specifically, cholinergic crisis. Organophosphates or carbamate pesticides produce similar effects to nerve agents.

**Signs and Symptoms of Nerve Agent Poisoning**
Caveat: Poisoned patients may not demonstrate all of these symptoms
- **Mouth/Skin:** Dribbling (Salivation), foaming at the mouth, and excessive sweating
- **Nose/Eyes:** Runny nose and watery eyes (Lachrymation) with small (often pleopod) pupils (Miosis)
- **Chest:** Cough, chest tightness, difficulty in breathing, wheezing, respiratory failure, “wet” Fluid Blinded lungs
- **Abdominal:** Vomiting, Diarrhea, abdominal (Gastrointestinal) cramps, belching, nausea, and/or vomiting (Emesis)
- **Nervous System:** Confusion, drowsiness, slurred speech, ataxia, unconsciousness, coma
- **Muscles/Nervous System:** Fatigue, weakness, twitching, tremors, cramps, absent reflexes, seizures

**Underlying Findings**
- **SLUDGE:** Salivation, Lachrymation, Urination, Diarrhea, Gastrointestinal cramps, Emesis
- Other synonymous terms: DUMBBELLS—Dribble, Urination, Miosis, Muscle weakness, Bronchospasm, Bronchoconstriction, Bradycardia, Emesis, Lachrymation, Salivation, Breathing

<table>
<thead>
<tr>
<th>Clinical Effects of Nerve Agents versus Opioids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nerve Agent</strong></td>
</tr>
<tr>
<td>Nose</td>
</tr>
<tr>
<td>Airway</td>
</tr>
<tr>
<td>Breathing / Respiratory status</td>
</tr>
<tr>
<td>Heart rate</td>
</tr>
<tr>
<td>Mental Status / Neurological</td>
</tr>
<tr>
<td>Eyes</td>
</tr>
<tr>
<td>Skin</td>
</tr>
<tr>
<td>skeletal muscle</td>
</tr>
<tr>
<td>Muscles</td>
</tr>
</tbody>
</table>

A KEY DISTINCTION BETWEEN NERVE AGENT POISONING AND OPIOID POISONING IS “SLUDGE” OR “DUMBBELLS.”
ASSAYS FOR SERUM/RBC CHOLINESTERASE

I: Ortho Diagnostics Vitros 950 automated chemistry analyzer pseudocholinesterase

II: Ortho Diagnostics DT-60 Point-of-care analyzer pseudocholinesterase

III: Manual spectrophotometry OR automated chemistry analyzer for RBC cholinesterase
A chemical attack results in victims being treated at area hospitals. Hospitals are categorized into three tiers:

- **Tier I**: Local Hospitals
  - TAT: 1-4 h

- **Tier II**: Regional Hospitals
  - DPHL
  - TAT: <24 h

- **Tier III**: National Hospitals
  - CDC, FBI, etc.
  - TAT: 1-7 d
FIELD DETECTION METHODOLOGIES

- Availability?
- Sensitivity?
- Specificity?
- Applicability?
- Familiarity?
- Expiration?

M8 Chemical Detection Paper

OVERVIEW:
The M8 Chemical Detection Paper is used to detect the presence of liquid nerve (V) and G-type and blister (H-) chemical agents.

DESCRIPTION:
The M8 booklet is made up of 25 M8 sheets. Each page has three sensitive indicator dyes on the page. When a sheet is brought into contact with liquid that contains nerve or blister agents, the indicator dyes in the paper react with the agents to produce colored dots. The color indicates the type of agent present.

There is a color chart inside the front cover of the booklet to help identify the agent detected. The colors indicate the following:

- Yellow – G-type Nerve Agents
- Red – H-type Blister Agents
- Dark Green – V-type Nerve Agents

Use:
M8 is used by tearing out a sheet and attaching it to clothing or some other surface so it can be exposed to drops of chemical liquid splash. The paper may also be placed in contact with a liquid that is suspected of contamination. If colored spots appear, a chemical agent is present.

M8 Paper cannot be used to detect chemical agents in water, or aerosol agents in the air. It does not detect vapors. It is best suited for non-porous materials.

In 2012, the State of California's FIRESCOPE Standardized Equipment List. Listed the

Agentase CAD (Chemical Agent Detection) Kit and Training Products

Highly selective measurement system detects chemical warfare agents

Manufacturer: Agentase, LLC 1101110002

Includes: Chemical Agent Detection Kit (CAD)
Set of one each of the following sensing sensors: Nerve Agent (G and V), Blood Agent (COX), Blood Agent (AC), Blister Agent (GD), and Blister Agent (HN). Because direct use of sensors is incompatible with high concentrations of organics, acids/bases, and discolored environments, a sample collector is also provided.

M18A3 Chemical Agent Detector Kit

NSN: 6665-01-465-4278

Overview:
The M18A3 Chemical Agent Detector Kit is designed primarily for detecting dangerous concentrations of vapors, aerosols, and liquid droplets of the chemical agents listed below. This kit will be used primarily by chemical specialty personnel assigned at the organizational level. This kit's capability provides for the sampling of unknown NBC agents. If a chemical agent is suspected but cannot be detected with the kit, vapor samples can be collected in sampling tubes for forwarding to a laboratory for identification. The principle uses of the kit are:

- For reconnaissance in areas suspected of chemical agent contamination.
- For finding the boundaries of contaminated areas.
- For determining the absence of a chemical agent so that following a chemical attack, unmasking can occur.
- For testing for the presence of a chemical agent after decontamination.
- For collecting samples of suspected but unidentified chemical agents.

Agents listed below are detected by the M18A3 Chemical Agent Detector Kit:
- Cyanogen Chloride (COX)
- Mustards (H1, H2, HN, and HF)
- Phosgene Oxime (COX)
- Hydrocyanic Acid (HC)
- Phosgene (CO)
- Lewisite (L)
- Ethyl Dichloroarsine (EC)
- Methyl Dichloroarsine (MD)
- Nerve Agents (V- and G-agents)

Shipping:

Catalog No.: 19-150-0440

$447.10 / Each

Qty: [ ] Check Availability

Add to Cart

Agentase, LLC
490 State St.
Rochester, NY 14601
Phone: 631-727-8600
Fax: 631-727-7592
Liquid FGA on M8 Paper – 10 Seconds

Liquid FGA on M8 Paper – 10 Minutes
NERVE AGENTS - TREATMENT

• Mark I kits (now combined as DuoDote)
  • Anticholinergic
    • atropine
  • Anti-anti-acetylcholinesterase
    • Pralidoxime

• Benzodiazepines for seizures
WHICH OXIME?

Fig. 1. Structures of eight oximes tested and atropine free base.
### NERVE AGENTS - COMPARISON

<table>
<thead>
<tr>
<th>AGENT:</th>
<th>Tabun (GA)</th>
<th>Sarin (GB)</th>
<th>Soman (GD)</th>
<th>VX</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{LC}_{50}$ (vapor)</td>
<td>400</td>
<td>100</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>min-mg/m³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{LD}_{50}$ (liquid)</td>
<td>1000</td>
<td>1700</td>
<td>350</td>
<td>6</td>
</tr>
<tr>
<td>mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aging 1/2 life</td>
<td>14 hours</td>
<td>5 hours</td>
<td>2 min</td>
<td>48 hours</td>
</tr>
</tbody>
</table>
AGING AND ACETYLCHOLINESTERASE REACTIVATION

Figure 4: Variable response to oximes of acetylcholinesterase inhibited by different classes of organophosphorus pesticides

Acetylcholinesterase was reactivated fully (A) quinalphos, a diethyl pesticide; partially (B) oxymethon-methyl, a dimethyl pesticide, or not at all (C) profenofos, an S-alkyl pesticide by oximes after poisoning. The arrow shows the time of first dose of pralidoxime. Normal acetylcholinesterase activity is about 600 mU/µmol Hb. In-vitro acetylcholinesterase activity shows how much of the enzyme can be reactivated, i.e. how much of it has not yet aged (in these three cases, on admission when the first dose of pralidoxime was given, A: ~85%, B: ~50%, C: 5%, of the enzyme was not aged). All patients presented to hospital within 4 h.
EDUCATION AND AWARENESS

- Multi-agency agreement on declassification
- Information across the responder, receiver, and law enforcement spectrum
- Distinction between opioids and nerve agent toxidromes and response
- "Rapid" dissemination
- Areas of ongoing uncertainty

https://chemm.nlm.nih.gov/nerveagents/FGA.htm
- **Safety Awareness for First On-Scene Responders Bulletin** – Designed to educate and prepare first responders for situations when law enforcement, fire, and emergency medical services (EMS) personnel are first to arrive on scene and initially may be unaware that a fourth generation agent is present. This bulletin will assist departments and agencies develop specific guidance and training to enhance overall preparedness efforts. ([PDF - 791 KB](#))

- **Reference Guide** – Designed to educate and prepare hazardous materials (HAZMAT) response teams, the guide includes chemical and physical properties of fourth generation agents, as well as detection, firefighting, personal protective equipment, and decontamination recommendations for situations when responding to a known or suspected fourth generation agent incident. This guide will assist HAZMAT response teams develop specific guidance and training to enhance overall preparedness efforts. ([PDF - 789 KB](#))

- **Medical Management Guidelines** – Designed to educate and prepare fire, EMS, and hospital staff and guide the medical management of patients exposed or potentially exposed to a fourth generation agent. ([PDF - 858 KB](#)) (Note: This is one PDF document that is divided into two Web pages, one for pre-hospital care and one for in-hospital care.)
  - *Pre-hospital Medical Management Guidelines*
  - *Hospital Medical Management Guidelines*
SUMMARY

- Recognition of HazMat situations and identification of toxidromes can minimize rescuer injury and improve patient care
  - Cholinergic crisis can be confused with Opioid toxidrome
    - FGAs have been only used in targeted (and bystander) assassination attempts to date
  - “Stress Reactions” are very common

- FGAs are primarily a dermal exposure concern
- Opioid exposures are not a dermal exposure concern

- In cases of clinical uncertainty, repeated BChE or single AChE measurements may be a useful laboratory tool to distinguish those with significant stress reactions
REFERENCES

- www.nbc-med.org
Figure 1. Association between oxime therapy and mortality: forest plot representation random effects model. The vertical straight line denotes null effect. The individual points denote the risk difference (RD) of each study and the lines on either side the 95% confidence intervals (CI). Oxime therapy was not associated with a significant increase in mortality.
• Probably attributable to detergents in intact commercial preparation
TOTAL OF 976 EVALUABLE PATIENTS

STUDY POPULATION REPRESENTATIVE OF LOCAL POPULATION DISTRIBUTION OF AGE AND GENDER
CHOLINSTERASE POPULATION STUDY

• Mean BChE: **7 +/- 1.6 U/mL**
  • Ortho DT-60

• Mean AChE: **5.6 +/- 2.3 U/mL**
  • Cobas Integra 800 series
  • Adjusted for Hb
INDIVIDUAL ACHE IS INDEPENDENT OF BCHE

- The AChE distribution of the lowest and highest BChe is the same as the median BChe individuals.
PLASMA CHOLINESTERASE RESULTS

% CV

BChE Result U/mL

% Standard Deviation

Number of Patients

0-1 1.01- 1.5 1.51- 2.0 2.01- 2.5 2.51- 3.0 3.01- 3.5 3.51- 4.0 4.01- 4.5 4.51- 5.0 5.01- 5.5 5.51- 6.0 6.01- 6.5 6.51- 7.0 7.01- 7.5 7.51- 8.0 8.01- 8.5 8.51- 9.0 9.01- 9.5 9.51- 10.0 10.0- 10.5 10.5- 11.0

0 10 20 30 40 50 60 70 80 90 100
RBC Cholinesterase for 3 subsets of Plasma Cholinesterase

Mean = 15.5
Mean(L) = 15.9
Mean(H) = 15.4