

# Tat t oos

The Living Canvas

**June 26, 2012**

**BCCDC Environmental Health Seminars**

The Tattoo Machine Study : Investigating Organic contaminants on a bagged and unbagged Tattoo machines

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TATTOO ARTIST

Tat t oos

# OVERVIEW

- WHAT IS TATTOOING
- ASSOCIATED RISK
- GOVERNANCE
- TATTOO MACHINE
- STUDY DESIGN
- PROCEDURE
- RESULTS
- DISCUSSION
- LIMITATIONS
- IMPLICATIONS



INTRODUCTION

# TATTOOING

- Any method of placing indelible ink or other pigments into or under the skin with needles or any other instruments resulting in permanent coloration of the skin
- Tattooing was widely practiced in many cultures in the ancient world as a form of identification/tribal marking
- Today tattoos are almost always used just for decoration

# TATTOO

- In 2008, 14% of the American population had at least one tattoo
- Estimated 20,000+ parlors operating in the United States
- Growing industry

# POPULARITY



LEGO Pirate



TokiDoki Barbie



Medical tattoos



ASSOCIATED  
RISK

# ASSOCIATED RISK

- **Blood Borne Infections**
  - Hepatitis B
  - Hepatitis C
  - HIV
- **Skin Infections**
  - *Staphylococcus aureus*
  - *Pseudomonas aeruginosa*
- **Acute Inflammatory Reactions**
  - Allergic contact dermatitis
  - Photoallergic dermatitis



# DOCUMENTED INFECTIONS

- In 2005, 44 cases of antibiotic-resistant Staph infection were linked to unlicensed tattoo parlors practicing suboptimal infection control practices and using non-sterile equipment
- Canadian researchers estimated that tattooing nearly triples the likelihood of HCV infection overall
- In Canada, 12 to 25 per cent of hepatitis C infections among prisoners are associated with tattooed individuals, compared to six per cent of the general population.



Governance

# TATTOO STUDIOS IN UNITED STATES

- All tattoo studios are required to be registered with the local Health Authority and tattooist are licensed
- Licensed tattooist
  - Bloodborne pathogens course
  - Prevention of disease transmission course
  - Infection control & aseptic techniques
  - 200 + hours of supervised experiences

# CANADIAN BODY ART INDUSTRY

- Several provinces have regulations & guidelines
  - Regulated Activities/ Personal Service Establishment Regulations
- Annual inspections & Approval letter
- Tattoo studios do not have to be registered with the Health Authority and tattooist are not licensed

# SELF GOVERNED

- Tattoo artist requirements
  - Vince(BCIT Instructor) is a "certified" tattooist
- Apprenticeship
  - Complex
    - 6 - 24 months
    - Blood Borne Pathogen course
    - Infection control training
    - Portfolio (50 - 200 drawings)
    - Fake skin/Fruits/Free tattoos
  - Simple
    - 2-week intensive course of over 100 hours
    - Opportunity for a 1 week supervised training



TATTOO  
MACHINE

# TATTOO MACHINE

- 3 types of tattoo machines
  - Rotary
    - Utilizes rotary bearings
  - Dual Coil
    - Uses electromagnets
  - Pneumatic
    - Runs on air compression
  
- Dual Coil is the most commonly used tattoo machine

# ROTARY MACHINE



The rotary type tattoo machine utilizes rotary bearings rather than springs to move the tattoo needle and deposit the ink into the skin.

- Quieter
- Less intimidating
- Not common
- New models are autoclave friendly



**Stigma-Rotary® FLY**

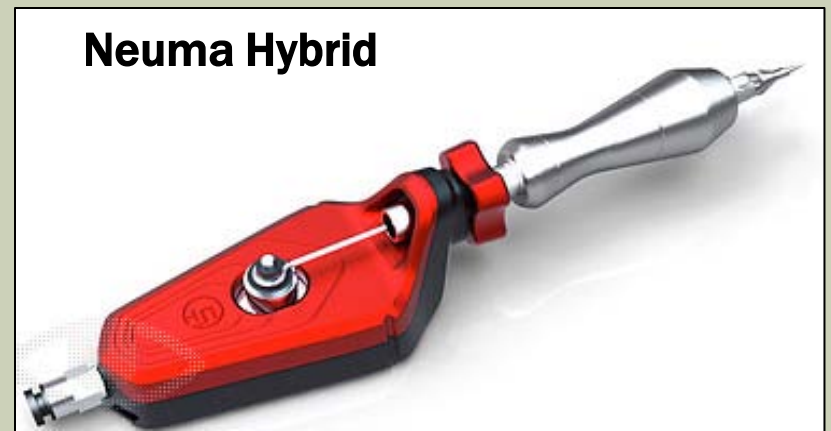


# Pneumatic Machine



- Lighter, about 2oz
- Autoclave friendly
- Relatively new

Pneumatic type tattoo machines run on air compression, rather than coils or bearings



**Neuma Hybrid**

# Dual Coil Machine

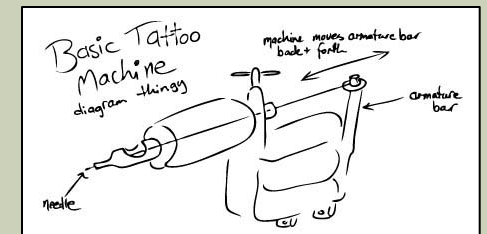
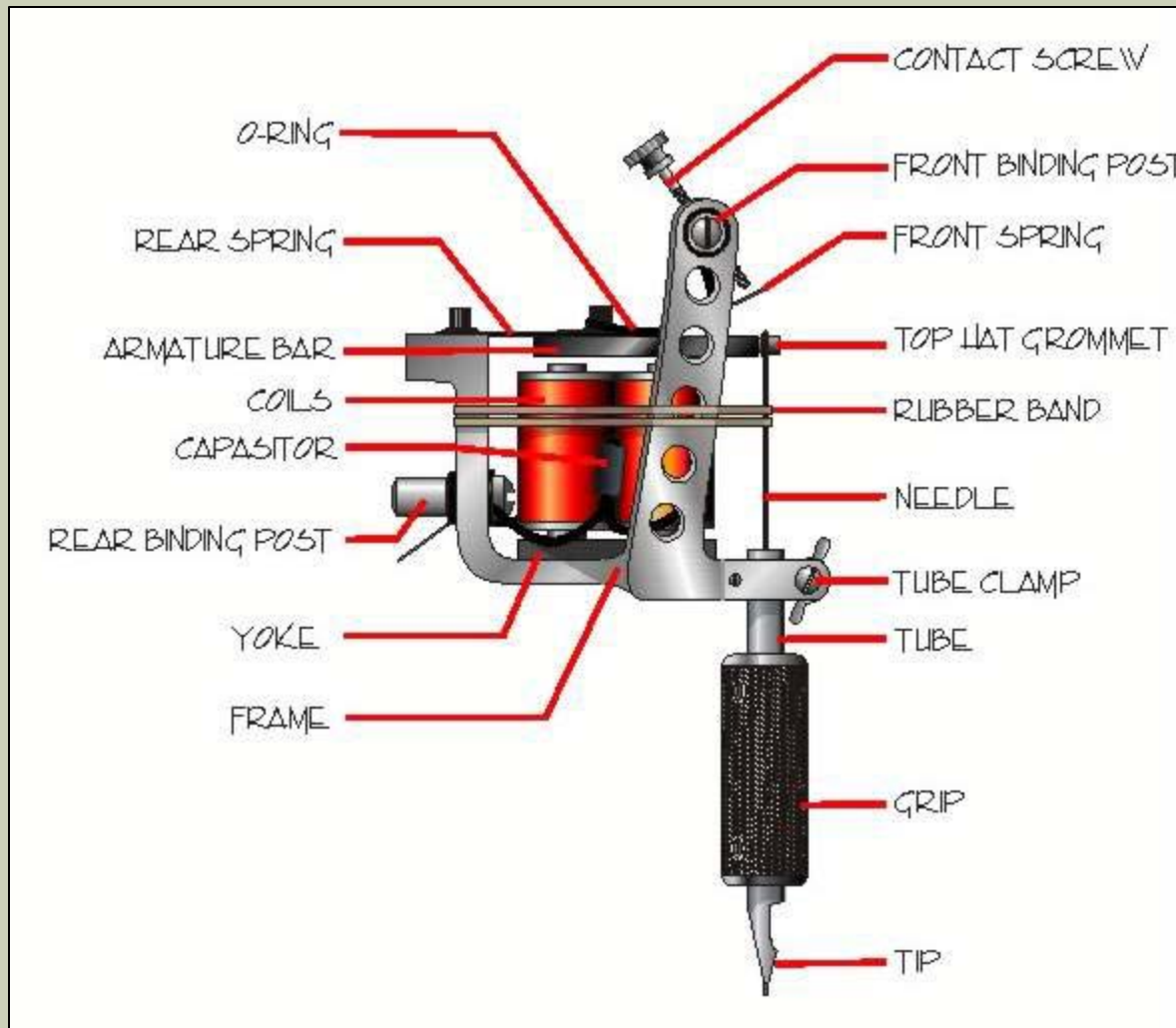


- Commonly found in parlors
- Greater precision
- Relatively cheap
- Two subtypes : Liner & Shader

The dual coil tattoo machines use wound copper coils that move the needle via springs. The mechanism is similar to that of a doorbell in that it uses electromagnetic current to force the needle down and up.

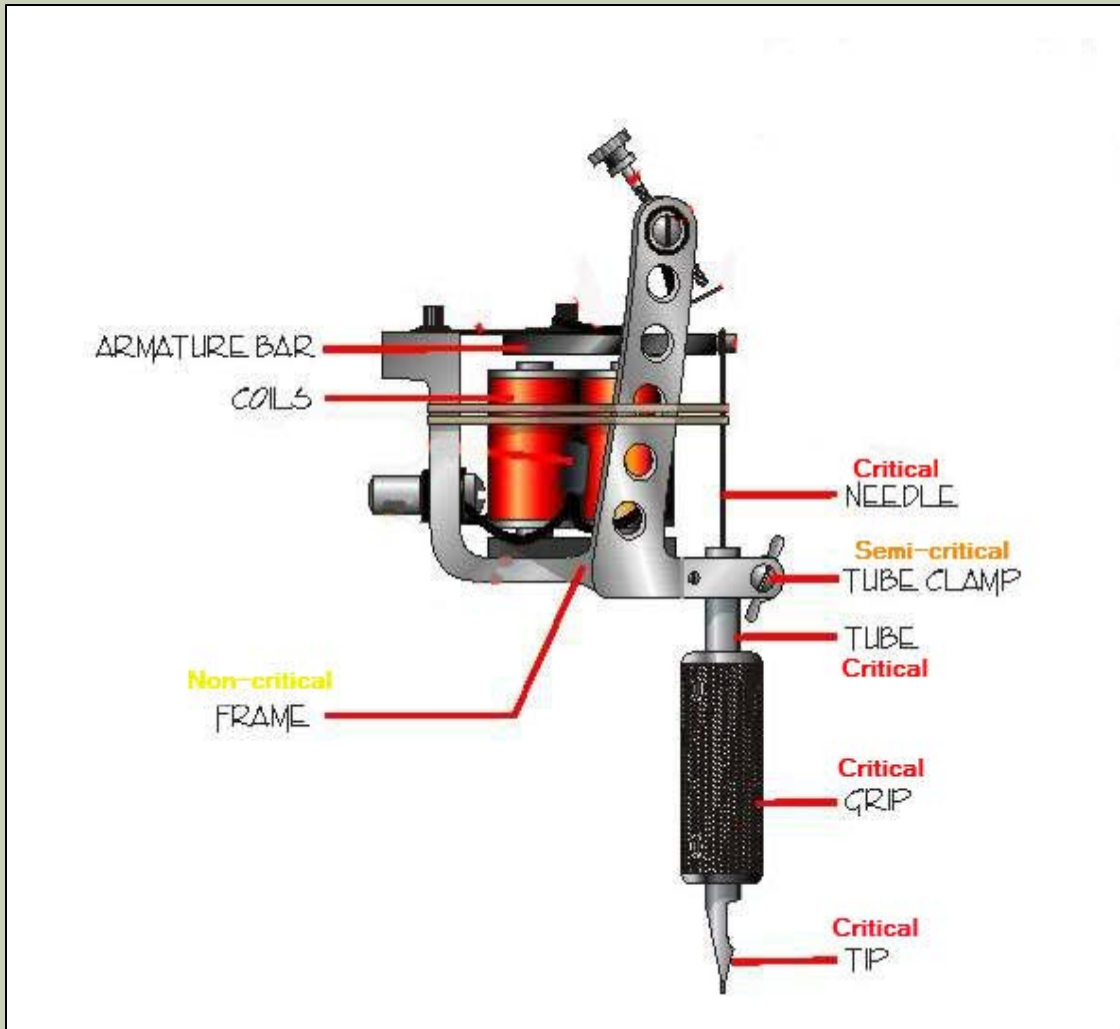


# DUAL COIL TATTOO MACHINE



# CATEGORIZATION

## TATTOO MACHINE



# STERILIZATION/DISINFECTION

<b>Item classification</b>	<b>Risk</b>	<b>Minimum level of treatment</b>	<b>Treatment used</b>	<b>Items at a tattoo parlor</b>
Non-critical	Low	Intermediate or Low level disinfectant	<ul style="list-style-type: none"><li>- 5.25% bleach</li><li>- Quats</li><li>- 3% hydrogen peroxide</li></ul>	<ul style="list-style-type: none"><li>- Spray bottle</li><li>- Clip cord</li><li>- Tattoo machine frame</li></ul>
Semi-critical	Moderate to high	High level disinfectant	<ul style="list-style-type: none"><li>- 2% gluteraldehyde</li><li>- 6% hydrogen peroxide</li></ul>	<ul style="list-style-type: none"><li>- Pigment/ink trays</li><li>- Chuck/clamp</li></ul>
Critical	Extremely high	Sterilization	<ul style="list-style-type: none"><li>- Steam autoclave</li><li>- Dry autoclave</li></ul>	<ul style="list-style-type: none"><li>- Tattooing needles</li><li>- Metal tube</li><li>- Grip</li></ul>

# TATTOO SETUP

We use disposable products whenever possible & disposable surface barriers to ensure a sterile environment at all times.

digital power supply with single use disposable surface barrier film applied.

Autoclavable nalgene bottles with single use disposable covers.

Single use disposable clip chord sleeve/cover.

Single use disposable medicine cup.

Single use disposable medical grade surface barrier.

Single use disposable tattoo machine covers.

Single use disposable tattoo needles in sealed sterile packaging, opened in front of client.

Sterile medical tool tray


Single use disposable tongue depressor & razor.

Single use disposable ink cups.

Single use disposable grommets & o-rings

Single use disposable tabs, grips & tips in sealed sterile packaging, opened in front of client.





Body  
Modification  
Workshop

# BODY MODIFICATION WORKSHOP

- The divide between tattoo artist
- Bagged Machine
  - The needle bar oscillates 50 -3000 times /min. The rapid movement creates an electrostatic charge which attracts contaminants
- Uncovered Tattoo Machine
  - Leaving the machine uncovered allows blood and contaminated ink to settle onto the machine.

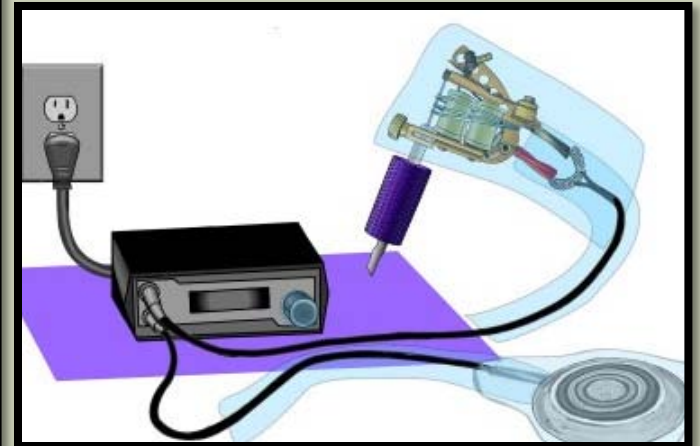


# INFECTION CONTROL AMONG PROFESSIONAL TATTOOIST STUDY

<i>Practice (Recommendation)</i>	<i>Percent reporting use of recommended practice</i>
Reuse needles (Never)	87
Break needles off bars using my hands (Never)	97
Discard used ink cups after finishing a tattoo (Always)	98
Change rubber bands on machine after each client (Always)	52
Cover machine with a disposable plastic cover when tattooing (Always)	34
Wear gloves on both hands during tattooing (Always)	100
Use the same setup to tattoo a husband and wife (Never)	97
Use a steam heat autoclave (Yes)	93
Autoclave equipment in sealed bags (Yes)	91
Use color dots on autoclave bags to monitor the autoclave (Yes)	98
Spore test the autoclave (Yes, monthly)	45

Raymond, M. (2001) " Infection Control among Professional Tattooists in Minneapolis and St. Paul,MN". Public Health Reports

# BAGGED TATTOO MACHINE



# WHAT IS THE HAZARD

- Personalized Tattoo machines
- Machine cannot be autoclaved
  - Damp-wiped with disinfectant
- Duration of procedure
- Post-procedure



# GUIDELINES FOR TATTOOING

Province	BC	AB	ON	SK	MB
Guidelines	Guidelines for Tattooing	Health Standards and Guidelines for Tattooing	Infection Prevention and Control Best Practices for Personal Services Settings	Health Canada: Infection Prevention and Control Practices For Personal Services: Tattooing, Ear/Body Piercing and Electrolysis	Personal Service Facility Guidelines
Preparation and Handling of Instruments and Equipment	All clip cords and spray bottles should have triggers and grasped areas protected by plastic bag or wrap which is disposed of after each client	The tattoo machine (motor frame), clip cord and spray bottles should be covered with a disposable plastic sheath. The plastic sheath should be disposed after each client.	Re-usable equipment/instruments and work contact surfaces that cannot be adequately cleaned, disinfected or sterilized (i.e. tattoo machines, spray bottles etc.) shall be covered with single use, disposable covers and the cover shall be discarded after each use.	The tattoo machine, clipcord, and spray bottle should be covered with plastic. Any other surfaces that are touched with contaminated gloves should be covered with plastic, The plastic should be replaced after the treatment of one client and before the next one.	Multi-use items that can not be properly cleaned and disinfected or sterilized may be prohibited (i.e. piercing gun that does not have a disposable sterile cartridge)  Refer to Health Canada Infection Prevention guidelines
Single-use cover recommended for clipcord/ plastic bottle	YES	YES	YES	YES	YES
Single-use cover recommended for tattoo machine	NO	YES	YES	YES	YES



Study  
Design

# PURPOSE

- Comparing the organic contaminants on bagged tattoo machine against the organic contaminants on unbagged tattoo machine to assess whether covering the machine has a change in organic load.

# METHODOLOGY

- Material & Equipment
  - Ultraspap™ ATP Surface Test
  - SystemSURE II™ ATP Hygiene Monitoring System
- Why use ATP Hygiene Monitoring System :
  - Easy to use
  - Reliable
  - Inexpensive
  - Self calibration

# BAGGED MACHINE

## EXPERIMENTAL PROCEDURE

The frame of the machine and electromagnets was dry swabbed using the Ultrasnap swab (R1)



The tattoo machine was bagged using a plastic cover



The client was tattooed and the duration of the tattooing procedure was recorded (Time)



The plastic cover was removed after the procedure



The frame of the machine and electromagnets was dry swabbed using a fresh Ultrasnap swab (R2)



The tattoo machine was disinfected using QUATS



# UNBAGGED MACHINE

## EXPERIMENTAL PROCEDURE

The frame of the machine and electromagnets was dry swabbed using the Ultrasnap swab (R1)



The client was tattooed and the duration of the tattooing procedure was recorded (Time)

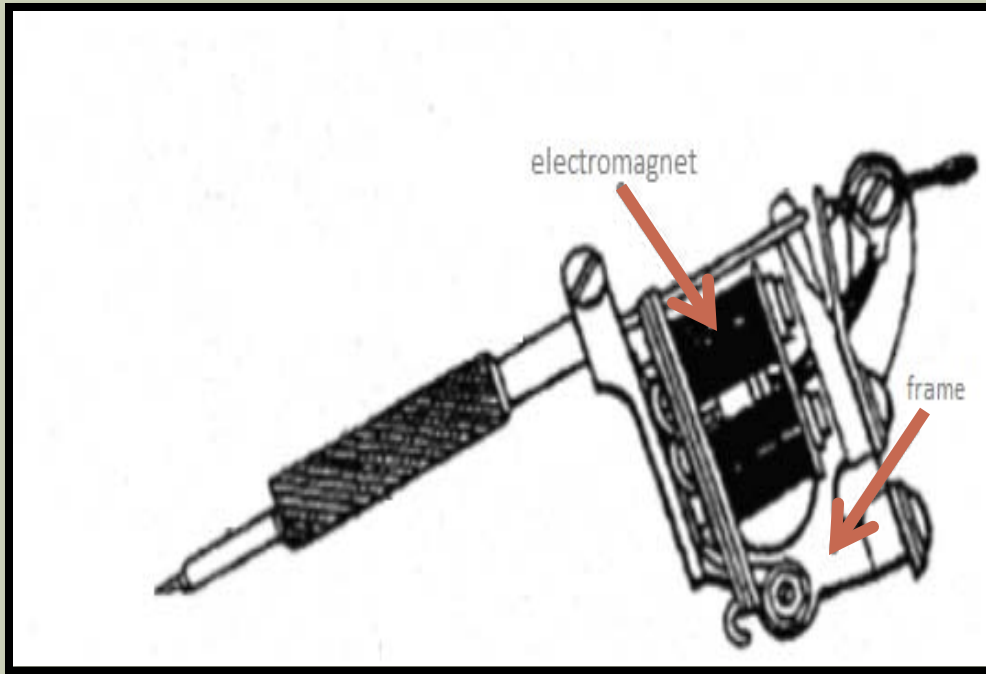


The frame of the machine and electromagnets was dry swabbed using a fresh Ultrasnap swab (R2)



The tattoo machine was disinfected using QUATS

# SAMPLES



- Electromagnets & machine frame
- Swabs refrigerated
- 10 mins RTP before sample collection

# STUDY DESIGN

## TRAINING

- Safety concerns
- Training
  - SystemSURE II™ ATP Monitoring System Operator's Manual
  - Ultrasnap™ ATP swab guide
  - Guide to ATP Hygiene Monitoring
  - BCIT, FOOD 3020 - Lab 6 Surface Sampling Methods
- Follow up

# INCLUSION & EXCLUSION

- Inclusion criteria

Any tattoo procedure performed by (1) & (2) using the dual coil tattoo machine at the tattoo studio

- Exclusion criteria

- Minors (18 and below)
- Intoxicated clients
- Lesions, wounds or any other observable skin condition
- Swabs that came in direct contact with blood or ink
- Tattoo machines that were not disinfected using QUATS

# VALIDITY & RELIABILITY

- Self Calibration
- Calibration Kit
- Training & Equipment Manual
- Follow-up
- Sampling area (frame and electromagnets)
- Before and After swabs

# PROPOSED TIMELINE

- 16 week sampling :
- 60 tattoo procedures
  - 30 bagged machine
  - 30 unbagged machine



# ACTUAL TIMELINE

- 6 week sampling :
- 38 tattoo procedures
  - 19 bagged machine
  - 19 unbagged machine

Jan 19th : ATP Monitoring System Calibrated

Jan 25<sup>th</sup> : Trained Elwood & Co.

Jan 26<sup>th</sup> : Pilot Project

Jan 29<sup>th</sup> : Sampling Begins

Feb 6th : Tattoo shop Renovation

Apr 19<sup>th</sup> : Tattoo Shop Reopens  
– Sampling Resumed

May 15<sup>th</sup> : 38 Tattoo procedures performed

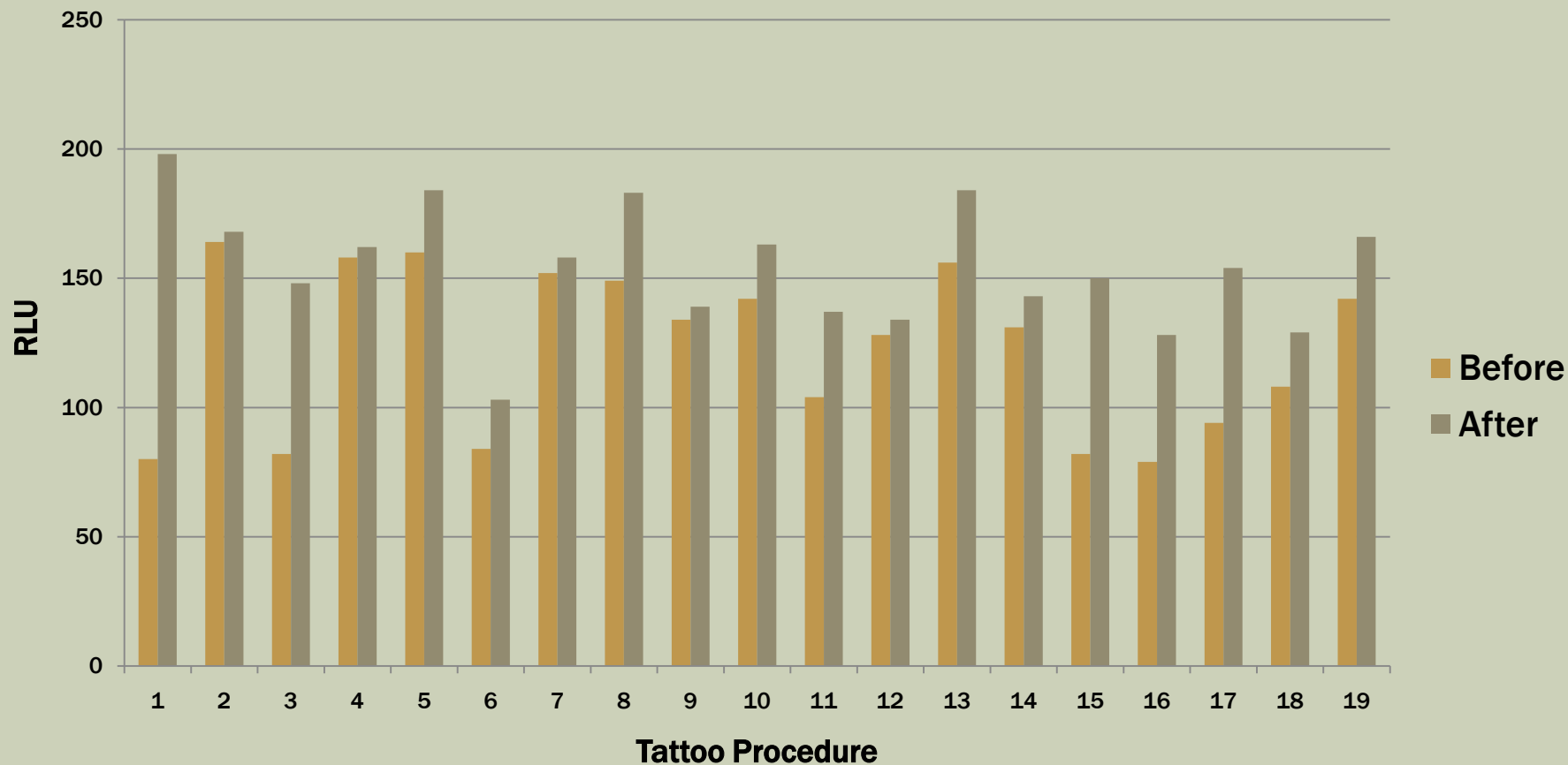
A black and white photograph showing a tattoo machine and its various components. The machine is positioned diagonally across the frame, with its handle on the left and the needle assembly on the right. The handle has a textured, knurled grip. The needle assembly is also knurled and has a sharp needle tip. In the foreground, there is a clear plastic tray containing several small, clear plastic caps or containers, some of which are open, revealing dark ink. The background is dark, and the lighting highlights the metallic and plastic surfaces of the equipment.

RESULTS



# UNBAGGED TATTOO MACHINE

**Organic Contaminants on Unbagged Tattoo Machine before and after the procedure**



# UNBAGGED TATTOO MACHINE

## DESCRIPTIVE STATS

DESCRIPTIVE STATISTICS	BEFORE	AFTER	DIFFERENCE
	RLU		
Mean	<b>123</b>	<b>154</b>	<b>32</b>
Standard Error	7	5	7
Median	131	154	24
Mode	82	184	4
Standard Deviation	32	24	29
Sample Variance	995	559	863
Kurtosis	-2	0	3
Skewness	0	0	2
Range	85	95	114
Minimum	79	103	4
Maximum	164	198	118
Sum	2329	2931	602
Count	19	19	19
Confidence Level(95.0%)	15	11	14
95% Confidence Interval	<b>108-138</b>	<b>143-165</b>	<b>18-46</b>

# UNBAGGED TATTOO MACHINE

## INFERENCEAL STATS

**H<sub>0</sub> :There is no difference in organic load (contaminant) on an unbagged tattoo machines before and after the tattoo procedure**

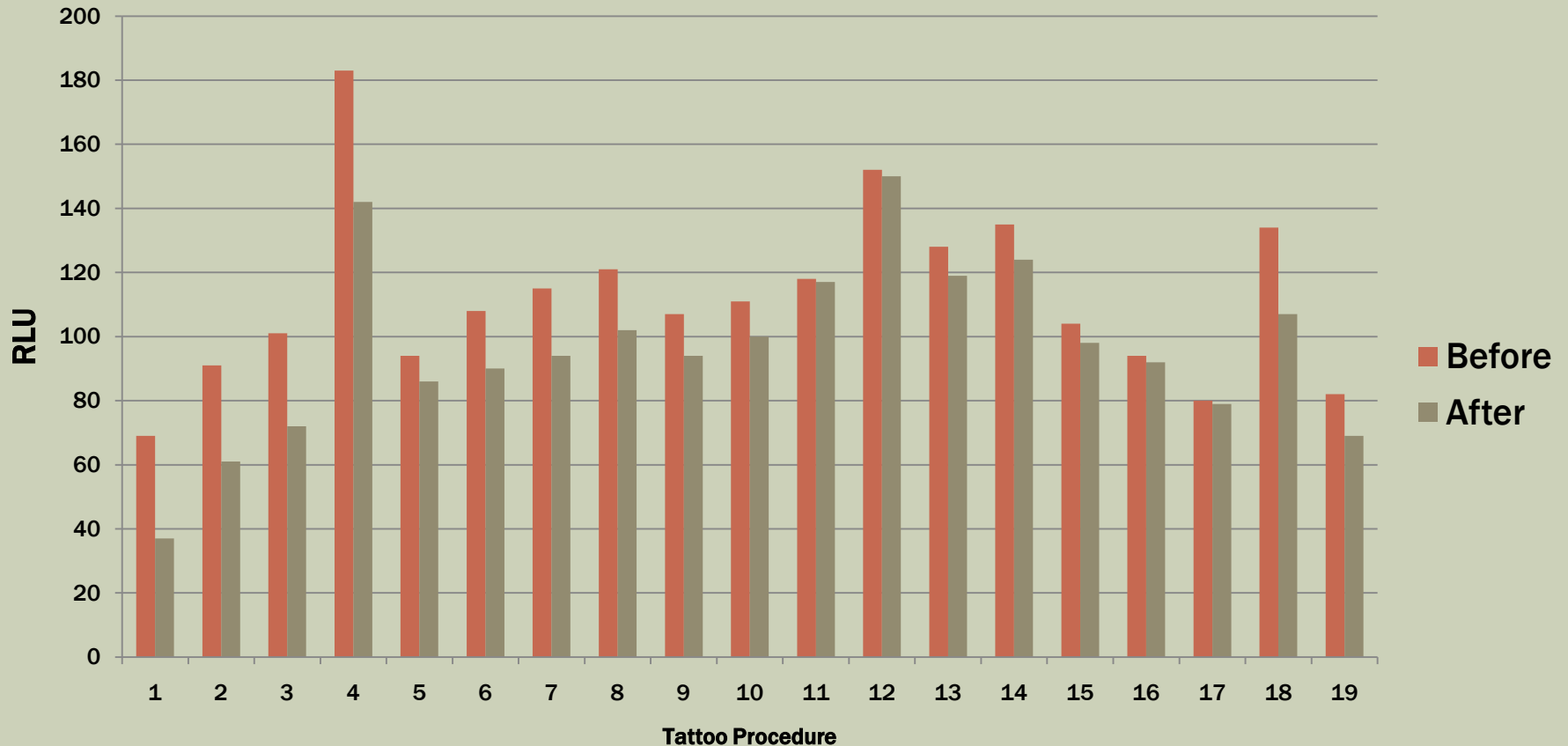
### Paired T-Test

Skewness Normality	Reject normality
Probability Level	0.000131
Reject H <sub>0</sub>	Y ES
Power	0.999934

- Paired T-Test
  - Significant
  - Low alpha error
  - High Power
  - Small sample size

# BAGGED TATTOO MACHINE

## Organic Contaminants on Bagged Tattoo Machine before and after the procedure



# BAGGED TATTOO MACHINE

## DESCRIPTIVE STATS

DESCRIPTIVE STATISTICS	BEFORE	AFTER	DIFFERENCE
	RLU		
Mean	<b>112</b>	<b>96</b>	<b>-15</b>
Standard Error	6	6	3
Median	108	94	-13
Mode	94	94	-13
Standard Deviation	27	27	12
Sample Variance	729	745	140
Kurtosis	1	0	-1
Skewness	1	0	-1
Range	114	113	40
Minimum	69	37	-41
Maximum	183	150	-1
Sum	2127	1833	-294
Count	19	19	19
Confidence Level(95.0%)	13	13	6
95% Confidence Interval	<b>99-125</b>	<b>83-109</b>	<b>(-21) - (-9)</b>

# BAGGED TATTOO MACHINE

## INFERENCEAL STATS

**H<sub>0</sub> :There is no difference in organic load (contaminant) on a bagged tattoo machines before and after the tattoo procedure**

### Paired T-Test

<b>Skewness Normality</b>	<b>Cannot reject normality</b>
<b>Probability Level</b>	<b>0.000011</b>
<b>Reject H<sub>0</sub></b>	<b>YES</b>
<b>Power</b>	<b>0.999679</b>

- **Paired T-Test**
  - Significant
  - Low alpha error
  - High Power
  - Small sample size

# COMPARISON

## DESCRIPTIVE STATS

DESCRIPTIVE STATISTICS	BAGGED	UNBAGGED
	RLU	
Mean	<b>15*</b>	<b>32</b>
Standard Error	3	7
Median	13*	24
Mode	13*	4
Standard Deviation	12	29
Sample Variance	140	863
Kurtosis	1	3
Skewness	1	2
Range	40	114
Minimum	41	4
Maximum	1	118
Sum	294	602
Count	19	19
Confidence Level(95.0%)	6	14
95 % Confidence Interval	<b>21* - 9*</b>	<b>18 - 46</b>

\* Absolute values

# COMPARISON

## INFERENCEAL STATS

**H<sub>0</sub> : There is no difference in organic load (contaminant) between a bagged tattoo machine and an unbagged tattoo machine after the tattoo procedure**

### Independent T-Test

Skewness Normality	Cannot reject normality
Probability Level	0.00000
Reject H <sub>0</sub>	YES
Power	0.999993

- **Independent T-Test**
  - Significant
  - Low alpha error
  - High Power
  - Small sample size
- **3 fold increase when machine left unbagged**



# COMPARISON

## BAGGED VS UNBAGGED TATTOO MACHINE

- 3 fold difference
  - The electrostatic charge on the plastic cover attracts contaminants
  - The removal of the plastic cover cleaned the machine of organic contaminants
  - The plastic cover acts like a protective barrier
- More studies required

# LIMITATIONS

- Time & budget constraints
  - 6 months + \$100/student
- Sample collection
  - Bias
- Sample population
  - Only 2 tattoo artists

# FURTHER STUDIES

- Larger sample population
  - Include more tattoo parlor
  - More tattoo artist
  - Controls
- Plastic cover
- Disinfection
  - Collect samples after disinfecting
- Correlation: Time vs Contamination

# CONCLUSION

- Significant difference in organic load
- 2 level of safety
  - Barrier + Disinfectant = safer
- Limits disease transmission
- Recommendations
  - Guidelines
  - EHO/PHI

# ACKNOWLEDGMENT

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QUESTIONS

# REFERENCES

- CDC (2006) “Methicillin-Resistant *Staphylococcus aureus* Skin Infections Among Tattoo Recipients --- Ohio, Kentucky, and Vermont, 2004–2005” MMWR June 23, 2006 / 55(24);677-679
- UBC (2010) “Tattooing linked to higher risk of hepatitis C: UBC study”  
<<http://www.publicaffairs.ubc.ca/2010/08/06/mr-10-109/>>
- Schildkrout.E, (2001) “Body art as visual language” *Anthro Notes*, 2001, pp. 1-8.
- Nishioka, S ,Gyorkos, T. Tattooing and risk for transfusion-transmitted diseases: the role of the type, number and design of the tattoos, and the conditions in which they were performed. *Epidemiol Infect.* 2002 February; 128(1): 63–71.
- Hellard ME, Aitken CK, Tattooing in prisons--not such a pretty picture.*Am J Infect Control.* 2007 Sep;35(7):477-80.
- Holsen DS, Harthug S, Myrmel H. Prevalence of antibodies to hepatitis C virus and association with intravenous drug abuse and tattooing in a national prison in Norway. *Eur J ClinMicrobiol Infect Dis* 1993;12:673-76.
- Methicillin-Resistant *Staphylococcus aureus* Skin Infections Among Tattoo Recipients --- Ohio, Kentucky, and Vermont, MMRW 2006 / 55(24);677-679
- Centers for Disease Control and Prevention (2008) Body Art: Tattoos and Piercings<http://www.cdc.gov/features/bodyart/>
- Noah N. Tattooing and piercing - the need for guidelines in EU. *Euro Surveill.* 2006;11(1):pii=589.
- Body Art Regulations, 2010, Minnesota Department of Health (MDH)  
<http://www.health.state.mn.us/divs/hpsc/hop/tattoo/brochure.html>
- Raymond, M. (2001) “ Infection Control among Professional Tattooists in Minneapolis and St. Paul,MN”. *Public Health Reports*, Vol 116, 2001, pp. 249-225
- Health Canada “ Infection Control Guidelines: Infection Prevention and Control Practices for Personal Services: Tattooing, Ear/Body Piercing, and Electrolysis”.*CCDR* July 1999.
- Saskatoon Health Region  
[http://www.saskatoonhealthregion.ca/your\\_health/ps\\_public\\_health\\_dental\\_547.htm](http://www.saskatoonhealthregion.ca/your_health/ps_public_health_dental_547.htm)
- BC Ministry of Health and Ministry of Responsible for Seniors. “Guidelines for Personal Service Establishments” 1995 - Revised 2000. PHI 079. 001.CH.PP.041.0154.
- Alberta Health and Wellness, (2002). Health Standards and Guidelines for Tattooing  
<http://www.health.alberta.ca/documents/Standards-Tattooing.pdf>

# REFERENCES

- Dvorak G. (2008) “ Disinfection 101”. The Center for Food Security & Public Health – Iowa State University  
<http://www.cfsph.iastate.edu/BRM/resources/Disinfectants/Disinfection101.pdf>
- Long. G, (1994). “Infectious Complications of Tattoos” *Clinical Infectious Disease*. Vol.18 (4): 610-619.
- Heacock, H., & Crozier, V. (2011). *Research Methods Manual*. ENVH 8400.
- Elwood, Professional Tattooist
- 3M Swab, 2002  
<http://multimedia.3m.com/mws/mediawebserver?mwsId=66666UuZjcFSLXt4XME5XTtEVuQEcuZgVs6EVs6E666666--&fn=70-2009-4504-9.pdf>
- HygeinaSystem SURE II ATP monitoring system ,2005  
[http://www.hygeina.net/docs/SS3\\_brochure.pdf](http://www.hygeina.net/docs/SS3_brochure.pdf)
- Alberta Health and Wellness, (2002). Health Standards and Guidelines for Tattooing  
<http://www.health.alberta.ca/documents/Standards-Tattooing.pdf>
- Hygeiena LLC, System SURE II Operator’s Manual & Software
- Food Standards, 2011 Guidelines for the microbiological examination
- Canadian Food Inspection Agency, 2010, Sampling and Testing  
<http://www.inspection.gc.ca/english/fssa/meavia/man/ch5/5-7e.shtml>
- Laser Removal, 2011 <http://www.laserremovaltips.com/2011/06/16/tattoo-machine-3/>
- Jordan, 2008 “Basic Fundamentals Of Modern Tattoo”. Tattoo Books Online LLC; 1st edition
- Fraser Health, 2011. “Personal Service Establishments”
- Manitoba Personal Service Facility  
[http://www.gov.mb.ca/health/publichealth/environmentalhealth/protection/docs/psf\\_guideline.pdf](http://www.gov.mb.ca/health/publichealth/environmentalhealth/protection/docs/psf_guideline.pdf)



# REFERENCES

## IMAGES

- Introduction <http://peterchristensen.deviantart.com/>
- Lego Dude <http://www.designboom.com/weblog/cat/8/view/11030/lego-tattoo-pilot-pen-ads.html>
- TokiDoki <http://www.barbiecollector.com/shop/doll/tokidoki-barbie-doll-t7939>
- Medical tattoo [diabeticszone.net](http://diabeticszone.net)
- Public Health Significance <http://peterchristensen.deviantart.com/>
- Governances <http://peterchristensen.deviantart.com/>
- Tattoo Machine <http://peterchristensen.deviantart.com/>
- Rotary Machine [www.stigma-rotary-tattoo.com/](http://www.stigma-rotary-tattoo.com/)
- Dual Coil Machine <http://www.livestrong.com>
- Pneumatic Machine <http://www.livestrong.com>
- Tattoo Machine <http://www.health.alberta.ca/documents/Standards-Tattooing.pdf>
- Tattoo Machine Design <http://www.tomstattooshop.com>
- Bagged tattoo machine <http://thebacksofmyeyelids.blogspot.com>
- Tattoo set up <http://mementomoristudios.ca>
- Study Design <http://philippeleroyersphotostream.flickr.com>
- Elwood : <http://lvanchan.flickr.com>
- Questions : <http://edlondonphotography.flickr.com>